Transport Canada

Transports Canada

Prairie and Northern Region - Aircraft Certification - RACD
800-1601 Airport Rd NE
Calgary, Alberta
T2E 6Z8

Your File Votre référence

Our file Notre référence

C-06-0052

April 18, 2006

AERO Design Ltd.
2013 – 39 Avenue, N.E.
Calgary AB
T2E 6R7

Subject: Robinson R22 / R44 Mirror Installation, SH06-3

Mr. Ted Burgoin,

This Supplemental Type Certificate (STC) is issued in response to your application, submitted by *AERO* Design Ltd., dated January 16, 2006.

The transfer of these documents in the name of another person requires a prior approval from the Minister in accordance with Canadian Aviation Regulations (CAR) 513.25. Please also consult CAR 571.06(4) for additional guidance.

A Canadian STC holder is required to report any service problem experienced with their product. Therefore, should you become aware of any defect, malfunction, or failure resulting from this design change approval, it is your responsibility to submit a Service Difficulty Report to Transport Canada in accordance with CAR Part V, Subpart 91.

Thank you,

Greg Oucharek, P. Eng
Senior Engineer, Aircraft Certification
(403) 292-4990
oucharg@tc.gc.ca

Canada

Transport Canada Transports Canada

Department of Transport

Supplemental Type Certificate

This approval is issued to:

Aero Design Ltd.
2013 39th Avenue North East
Calgary, Alberta
Canada T2E 6R7

Number: SH06-3
Issue No.: 1
Approval Date: April 18, 2006
Issue Date: April 18, 2006

Responsible Office: Prairie and Northern

Aircraft/Engine Type or Model: ROBINSON R22, R44

Canadian Type Certificate or Equivalent: ROBINSON R44 H-97
ROBINSON R22 H10WE

Description of Type Design Change: Robinson R22/R44 Mirror Installation

Installation/Operating Data, Required Equipment and Limitations:

Mirror Installation to be in accordance with Transport Canada approved *AERO* Design Ltd. Document Control List DCL649, Rev 0, or later Transport Canada approved revision.

Instructions for Continued Airworthiness contained in *AERO* Design Ltd. document ICA649.90, Rev 0, or later applicable revision are required with this installation.

– End –

DEPARTMENT OF TRANSPORT CANADA MINISTÈRE DES TRANSPORTS

Conditions: This approval is only applicable to the type/model of aeronautical product specified therein. Prior to incorporating this modification, the installer shall establish that the interrelationship between this change and any other modification(s) incorporated will not adversely affect the airworthiness of the modified product.

Greg Oucharek
For Minister of Transport

Canada

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
64901	R44 Installation	0
64902	R22 Installation	0
ICA649.90	Instructions for Continued Airworthiness	0
FABRICATION DOCUMENTS		
64920	Mirror Assembly	0
64921	Parts Fabrication	0
ENGINEERING DOCUMENTS		
ER649.01	Engineering Report	0
FTP649.02	Flight Test Plan	2

APPROVAL:

Transport Canada / Transports Canada
AIRCRAFT CERTIFICATION DIVISION
APPROVED
By
Appr'l No. SH06-3
Appr'l Date 2006-04-18
Issue No. 1
Issue Date 2006-04-18
YY - MM - DD

ORIGINAL DATE:
31 March 2006
REVISION DATE:

AERO DESIGN LTD.
2013 – 39th Ave NE, Calgary, Alberta, T2E 6R7
Ph. (403) 250-8027
Fax. (403) 250-8333

SHEET 1 OF 1

Robinson R22 / R44
Mirror Installation

DCL649

Rev. **0**

APPLICANT: AERO Design Ltd.
2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

CORRESPONDANCE TO: AERO Design Ltd.
(If other than applicant) 2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

DATE: January 16, 2006
REV. No. 2 30 January, 2006

MAKE: Robinson
MODEL: R22, R44

REGISTRATION: All eligible
SERIAL No.: All eligible

NATURE OF WORK: Mirror Installation

MODEL CERTIFICATION BASIS: FAR 27, February 1, 1965, including amentments 27-1 through 27-24
MODIFICATION CERTIFICATION BASIS: FAR 27, February 1, 1965, including amentments 27-1 through 27-24

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B	**Flight**				
27.29	Empty Weight and Corresponding C of G	Weight and Balance data on inst. dwg		X	
27.45	Performance – General	Flight Test	X		
27.51	Takeoff	Flight Test	X		
27.65	Climb: All Engines Operating	Flight Test	X		
27.73	Performance at Minimum Operating Speed	Flight Test	X		
27.75	Landing	Flight Test	X		
27.79	Limiting Height-Speed Envelope	Flight Test	X		
27.141	Flight Characteristics – General	Flight Test	X		Flight test to determine that installation does
27.143	Controllability and Maneuverability	Flight Test	X		not cause excessive vibration of the landing
27.161	Trim Control	Flight Test	X		gear in accordance with Flight Test Plan
27.171	Stability: General	Flight Test	X		FTP649.02, to be witnessed by DAR 290M
27.173	Static Longitudinal Stability	Flight Test	X		
27.175	Demonstration of Static Longitudinal Stability	Flight Test	X		
27.177	Static Directional Stability	Flight Test	X		
27.231	General	Flight Test	X		
27.251	Vibration	Flight Test	X		
Subpart C	**Strength Requirements**				
27.301	Loads	Statement in report		X	
27.303	Factor of Safety	Statement in report		X	Mirror weighs about 0.5 lb. Loads are not
27.305	Strength and Deformation	Statement in report		X	significant
27.307	Proof of Structure	Statement in report		X	

PER COORDP WITH TARDC

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
27.337	Limit Maneuvering Load Factor	Statement in report		X	Mirror weighs about 0.5 lb. Loads are not
27.561	Emergency Landing Conditions – General	Statement in report		X	significant
Subpart D	**Design and Construction**				
27.601	General	Use of conventional design		X	
27.603	Materials	Specification on drawings		X	
27.605	Fabrication Methods	Specification on drawings		X	
27.607	Fasteners	Specification on drawings		X	
27.609	Protection of Structure	Specification on drawings		X	
27.611	Inspection Provisions	Design		X	
27.613	Mat'l Strength Properties and Design Values	Use of MIL-HDBK-5		X	
27.629	Flutter	Flight Test	X		Flight test to determine that installation does not cause excessive flutter of the landing gear
Subpart G	**Operating Limitations and Information**				
27.1529	Instructions for Continued Airworthiness	ICA provided	X		

GREYHOUND CDA TRANS CORP

GST NO.891646655RT1 WAYBILL NO. 73220516935

LIABILITY LIMITED TO $50 FOR LOSS OR DAMAGE HOWSOEVER OCCASIONED UNLESS A GREATER VALUE DECLARED AT TIME OF SHIPPING. REFER TO TERMS AND CONDITIONS OF CARRIAGE FOR DETAILS OR CONSULT AGENT.

FT ST JOHN BC

COLLECT

CALGARY NORTH 220 166125
03/19/07 4:56 PM 10
ACTUAL WEIGHT 1.0 LBS
DECLARED VALUE 100.00

CONSIGNEE

REF:

BAILEY HELICOPTERS LTD

1 BOX

FT ST JOHN BC 250-785-2518

EXPRESS	18.60
FUEL S/C	0.79
GSTBC	1.16

SHIPPER

AERO DESIGN

CALGARY AB 403-250-8027
REFERENCE:

TOTAL 20.55

STATION TO STATION

FORM 256 REV 01/10/03

SHIPPER RECEIPT

Transport Canada Transports Canada

Department of Transport

Supplemental Type Certificate

This approval is issued to:

Aero Design Ltd.
2013 39th Avenue North East
Calgary, Alberta
Canada T2E 6R7

Number: SH06-3
Issue No.: 1
Approval Date: April 18, 2006
Issue Date: April 18, 2006

Responsible Office: Prairie and Northern

Aircraft/Engine Type or Model: ROBINSON R22, R44

Canadian Type Certificate or Equivalent: ROBINSON R44 H-97
ROBINSON R22 H10WE

Description of Type Design Change: Robinson R22/R44 Mirror Installation

Installation/Operating Data, Required Equipment and Limitations:

Mirror Installation to be in accordance with Transport Canada approved *AERO* Design Ltd. Document Control List DCL649, Rev 0, or later Transport Canada approved revision.

Instructions for Continued Airworthiness contained in *AERO* Design Ltd. document ICA649.90, Rev 0, or later applicable revision are required with this installation.

– End –

Conditions: This approval is only applicable to the type/model of aeronautical product specified therein. Prior to incorporating this modification, the installer shall establish that the interrelationship between this change and any other modification(s) incorporated will not adversely affect the airworthiness of the modified product.

Greg Oucharek
For Minister of Transport

Canada

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
64901	R44 Installation	0
64902	R22 Installation	0
ICA649.90	Instructions for Continued Airworthiness	0
FABRICATION DOCUMENTS		
64920	Mirror Assembly	0
64921	Parts Fabrication	0
ENGINEERING DOCUMENTS		
ER649.01	Engineering Report	0
FTP649.02	Flight Test Plan	2

APPROVAL:

ORIGINAL DATE:

31 March 2006

REVISION DATE:

AERO DESIGN LTD.
2013 – 39th Ave NE, Calgary, Alberta, T2E 6R7
Ph. (403) 250-8027
Fax. (403) 250-8333

SHEET 1 OF 1

Robinson R22 / R44
Mirror Installation

DCL649

Rev. **0**

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS
ICA 649.90

MIRROR INSTALLATION

Robinson R22, R22 Alpha/Beta/Mariner
Robinson R44, R44 II

Preface

These Instructions for Continued Airworthiness shall be included in the Robinson R22 (series) or R44 (series) Maintenance Manual when the Mirror is installed in accordance with AERO Design Ltd. Document Control List DCL649, Revision 0, or later approved revision.

The information contained herein supplements the information in the basic Maintenance Manual. For Maintenance practices and procedures not contained in these Instructions for Continued Airworthiness refer to the basic Maintenance Manual and its approved supplements.

Revision 0
Date: 26 January, 2006

AERO Design Ltd.

2013 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333

RECORD OF REVISIONS

Revision Number	Issue Date	Date Inserted	By
0			Original Issue

LIST OF EFFECTIVE PAGES

Chapter – Section - Subject	Page	Revision No.
5-TITLE	1	0
5-EFFECTIVITY	2	0
5-00-00	3	0
5-10-00	4-8	0

TABLE OF CONTENTS

SECTION 5 – LANDING GEAR

5-1 INTRODUCTION

The following Instructions for Continued Airworthiness (ICA) satisfy the requirements of 14 CFR 27.1529, and provide the information necessary to complete the on-going maintenance and inspections required for the Robinson R22 series and R44 series rotorcraft when modified with the Mirror Installation as described herein. The installation is the same for all models of R22 and R44 rotorcraft except as noted.

5-2 REFERENCE DOCUMENTS

AERO Design Ltd. Installation drawing 64901 (R44) and 64902 (R22)

5-3 DEFINITIONS AND ABBREVIATIONS

BL - Butt Line (RBL is Right Butt Line, LBL is Left Butt Line)
FS - Flight Station
ICA - Instructions for Continued Airworthiness
P/N - Part Number

5-4 GENERAL DESCRIPTION

The Mirror Installation consists of a commercially available convex mirror that is attached to the forward end of the right skid tube. The mirror is to allow the pilot to monitor loads slung from the cargo hook.

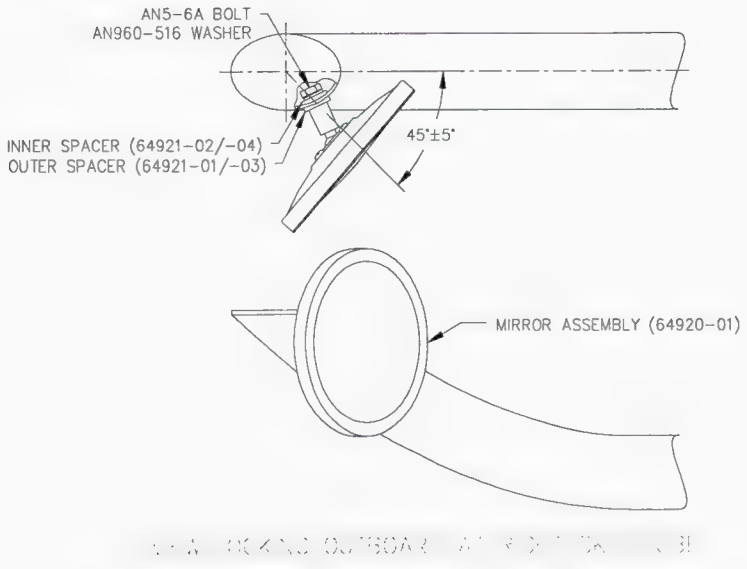


Figure 1 – Mirror Installation

5-5 CONTROL AND OPERATING INFORMATION

Not applicable.

5-6 SERVICING INFORMATION

The Mirror Installation does not affect the original rotorcraft servicing information. All components used with the Mirror Installation are "On Condition" items. Periodic servicing is not required.

1. Mirror Adjustments

a) If the mirror will not hold the desired position, tighten the screws on the back of the mirror to adjust clamp-up on the ball joint.

b) If the mirror cannot be moved to the desired position, loosen the screws on the back of the mirror to adjust clamp-up on the ball joint.

5-7 MAINTENANCE INSTRUCTIONS

1. Inspection Schedule and Instructions

Continued airworthiness is contingent upon compliance with the following inspection items. These items shall be completed in conjunction with the Robinson R22 or R44 Maintenance Inspection schedule, or other approved program, or upon removal and replacement of any component of the Mirror Installation.

Daily Inspection

1. Inspection Area: Skid Tube

a) Inspect the mirror for any signs of damage, cracks or corrosion.
b) Inspect skid tube at mirror attachment for any signs of damage, cracks or corrosion.
c) Inspect the mirror attachment for condition and security.

100 hour or Annual Inspection

1. Inspection Area: Skid Tube

a) Remove mirror assembly.
b) Inspect mirror for any signs of damage, cracks, or corrosion.
c) Inspect fastener holes in skid tube for elongation, wear, or other damage.
d) Re-install mirror.

2. Repair Instructions

1. Mirror Lug

The mounting lug may be cadmium plated steel (depending on the manufacturer). If cadmium plating is scratched and the lug begins to corrode, the corrosion must be removed or the mirror assembly must be replaced.

a) Remove all traces of corrosion by abrasive or chemical means. Protect mirror surface and housing from abrasives or chemicals.

Caution: Follow manufacturers instructions and safety precautions when using chemicals.

b) Prime and paint lug.

2. Mirror

If mirror is damaged, cracked or corroded, discard and replace with new mirror.

Acceptable mirrors:

Signal-Stat 7315 (5" Diameter)
Signal-Stat 7318 (6" Diameter)

If the above mirrors cannot be located, an alternate may be obtained from any commercial auto-parts supply store. The mirror must meet the requirements shown in Figure 2.

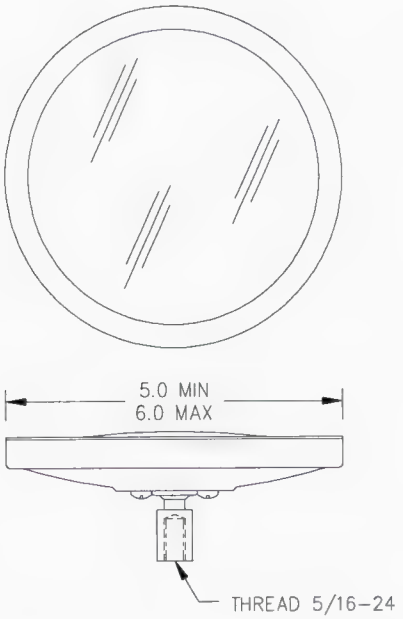


Figure 2 – Mirror Requirements

5-8 TROUBLE SHOOTING INFORMATION

Not applicable.

5-9 REMOVAL AND REPLACEMENT INFORMATION

1. Mirror Removal

Refer to figure 1.

1. Remove end cap from forward tip of right skid tube. Cap is secured with sealant. Remove all traces of sealant from cap and skid tube.
2. Unthread mirror from AN5 bolt.
3. Remove one (1) AN5-6A bolt, one (1) AN960-516 washer, one (1) 64921-01 (R44) or 64921-03 (R22) outer spacer and one (1) 64921-02 (R44) or 64921-04 (R22) inner spacer.

4. Re-install cap on forward end of skid tube using PR1422B2 sealant or equivalent.

Note: If mirror installation is to be permanently removed, do not perform step 3. Install MS21044N5 nut on AN5 bolt. Torque to 100-140 in-lbs. Continue with step 4.

2. Mirror Installation

Refer to figure 1.

1. Remove end cap from forward tip of right skid tube. Cap is secured with sealant. Remove all traces of sealant from cap and skid tube.
2. Insert (1) AN5-6A bolt with one (1) AN960-516 washer and one (1) 64921-02 (R44) or 64921-04 (R22) inner spacer in hole in forward end of skid tube.
3. Place one (1) 64921-01 (R44) or 64921-03 (R22) outer spacer on AN5 bolt. Ensure inner and outer spacers are correctly aligned with skid tube.
4. Apply Loctite 262 or equivalent to AN5 bolt. Thread mirror assembly 64920-01 onto AN5 bolt. Torque bolt to 100-140 in-lbs.
5. Re-install cap on forward end of skid tube using PR1422B2 sealant or equivalent.

5-10 MARKINGS AND PLACARDS

Not applicable.

5-11 DIAGRAMS OF ACCESS PANELS

Not applicable.

5-12 SPECIAL INSPECTION TECHNIQUES AND INSTRUCTIONS

1. Hard Landing

Following a hard landing inspect the Mirror Installation in accordance with the daily inspection listed above in Section 5-7.

5-13 PROTECTIVE TREATMENT INFORMATION

The mirror housing is fabricated from stainless steel and does not require any additional protective treatment.

The mounting lug may be cadmium plated steel (depending on the manufacturer). If cadmium plating is compromised, any corrosion must be removed (see section 5-7) and the lug must be primed and painted.

5-14 STRUCTURAL FASTENER DATA

Refer to basic helicopter maintenance manual.

5-15 LIST OF SPECIAL TOOLS

Not applicable.

5-16 AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section is Transport Canada approved and specifies maintenance required under Section 571 of the Canadian Aviation Regulations, unless an alternative program has been approved.

No additional limitations have been imposed due installation of the Mirror Installation.

5-17 DISTRIBUTION AND AMENDMENTS

Copies of this ICA and amendments shall be distributed to all known purchasers of the Mirror Installation.

AERO DESIGN LTD.
2013 – 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027
Fax: 403-250-8333
aerodesign@telusplanet.net

31 March, 2006

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : C-06-0052
Our File : 649

Re: Robinson R22/R44 Mirror Installation

Greg,

Please find attached the following documents related to this project:

AE 100 Form	AE649	Revision 0
Compliance Program	CP649	Revision 0
Document Control List	DCL649	Revision 0
Engineering Report	ER649.01	Revision 0
Drawings		
R44 Installation	64901	Revision 0
R22 Installation	64902	Revision 0
Mirror Assembly	64920	Revision 0
Parts Fabrication	64921	Revision 0

Regards,

E. Burgoin, P.Eng, DAR 290M

Encl.

CP INITIALED BY TED

DOCUMENT CONTROL LIST

DOCUMENT NO.	DOCUMENT CONTENT	REVISION
INSTALLATION DOCUMENTS		
64901	R44 Installation	0
64902	R22 Installation	0
ICA649.90	Instructions for Continued Airworthiness	0
FABRICATION DOCUMENTS		
64920	Mirror Assembly	0
64921	Parts Fabrication	0
ENGINEERING DOCUMENTS		
ER649.01	Engineering Report	0
FTP649.02	Flight Test Plan	2

APPROVAL:

ORIGINAL DATE:
31 March 2006
REVISION DATE:

AERO DESIGN LTD.
2013 – 39th Ave NE, Calgary, Alberta, T2E 6R7
Ph. (403) 250-8027
Fax. (403) 250-8333

SHEET 1 OF 1

Robinson R22 / R44
Mirror Installation

DCL649

Rev. **0**

FORM AE-100

DEPARTMENT OF TRANSPORT STATEMENT OF COMPLIANCE OF AIRCRAFT OR AIRCRAFT COMPONENTS WITH THE AIRWORTHINESS REQUIREMENTS		AE-100 No.: Initial Issue Date: Revision: Revision Date: Approval No.: Delegation No.: Delegate Name: Classification of Designee: Employer:	AE649 31 March, 2006 0 SH06-3 290M E. Burgoin *AERO* Design Ltd.
Aircraft Mfgr: Robinson Aircraft Model: R22, R44 Registration: All Eligible	Model Type Airplane ☐ Helicopter ☒ Appliance ☐ Component ☐		

LIST OF APPROVED REPORTS AND DATA

Document Number		Document Title	Compliance Status
DCL649	Revision 0	Document Control List and all documents referred to therein	As per Compliance Program, CP649, Revision 0 (Attached)
ER649.01	Revision 0	Engineering Report	
64901	Revision 0	R44 Installation	
64902	Revision 0	R22 Installation	
64920	Revision 0	Mirror Assembly	
64921	Revision 0	Parts Fabrication	
		DATA APPROVED BY TRANSPORT CANADA	
FTP649.02	Revision 2	Flight Test Plan	
ICA649.90	Revision 0	Instructions for Continued Airworhtiness	

CERTIFICATION

UNDER THE AUTHORITY VESTED IN ME BY THE DEPARTMENT OF TRANSPORT, I HEREBY CERTIFY THAT THE DATA LISTED ABOVE AND ON THE ATTACHED SHEETS NUMBERED Nil HAVE BEEN EXAMINED IN ACCORDANCE WITH ESTABLISHED PROCEDURES AND FOUND TO COMPLY, TO THE BEST OF MY KNOWLEDGE AND BELIEF WITH THE PERTINENT COMPLIANCE REQUIRMENTS.

I THEREFORE [☐] RECOMMEND FOR APPROVAL OF THESE DATA

[☒] APPROVE THESE DATA

E. Burgoin, DAR 290M

AERO DESIGN LTD.
2013 – 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027
Fax: 403-250-8333
aerodesign@telusplanet.net

13 February 2006

E & B Helicopters Ltd.
P.O. Box 1000
Campbell River, BC
V9W 6Y4

Attn: Ed Wilcock

Re: R22 and R44 Flight Tests

Ed:

Please find attached the following documents related to this project:

Robinson R22 Flight Test Report
Robinson R44 Flight Test Report

Could you please sign both reports in the indicated position on the last page and return to me.

Documents have been submitted to Transport Canada but the flight test person responsible for signing off on this is away until the beginning of next week. Hopefully things will move along quickly when he returns.

Regards,

Edward Burgoin

Encl.

Aircraft: C-GFSZ
Robinson R44 , Serial no. 0751

02 February 2006
Location: Campbell River BC

Configuration: 2,162 lbs. at take-off
CG at 95.85 (limited by fuel and occupant location – no additional ballast)
Right Skid Tube Mirror not installed.
No other external modifications installed on the aircraft.

Crew: Pilot: Ed Wilcock, E & B Helicopters
DAR: Ted Burgoin, Aero Design Ltd.

Base Line Flight without Mirror installed

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	24.0	30.0
- sideward flight to 20 mph to right- adequate pedal remaining	25.25	29.5
- sideward flight to 20 mph to left – adequate pedal remaining	23.25	29.75
- backward flight to 20 mph - neutral pedal	24.0	29.5

Observations:

a) adequate control margins were maintained.

Forward Flight

- cruise	55 kts Manifold Pressure: 14.75 "Hg		
	Straight ahead	24.25	27.75
	left turn – 30 degrees bank - neutral pedal	24.5	28.25
	right turn – 30 degrees bank - neutral pedal	24.5	28.0
- cruise	70 kts Manifold pressure: 17.75 "Hg		
	Straight ahead	24.25	27.0
	left turn – 30 degrees bank - neutral pedal	23.75	26.25
	right turn – 30 degrees bank - neutral pedal	24.75	27.25
- cruise	80 kts Manifold Pressure: 18.5 "Hg		
	Straight ahead	24.5	26.75
	left turn – 30 degrees bank - neutral pedal	24.0	26.75
	right turn – 30 degrees bank - neutral pedal	24.75	27.0
- cruise	90 kts Manifold Pressure: 19.5 " Hg		

	Straight ahead	24.5	26.0
	left turn – 30 degrees bank - neutral pedal	24.5	26.0
	right turn – 30 degrees bank - neutral pedal	24.5	26.0
- cruise	100 kts		
	Manifold pressure: 22.2 "Hg		
	Straight ahead	24.25	25.0
	left turn – 30 degrees bank - neutral pedal	24.25	25.25
	right turn – 30 degrees bank - neutral pedal	24.25	25.25
- cruise	110 kts		
	Manifold pressure: 24.0 "Hg		
	Straight ahead	24.5	24.75
	left turn – 30 degrees bank - neutral pedal	24.5	25.25
	right turn – 30 degrees bank - neutral pedal	24.25	25.0
- cruise	117 kts (V_h)		
	Manifold pressure: 26.0 "Hg		
	Straight ahead	24.25	24.0
	left turn – 30 degrees bank - neutral pedal	24.25	24.25
	right turn – 30 degrees bank - neutral pedal	25.0	24.25
-cruise	Max continuous power		
	descending to achieve V_{ne}		
	V_{ne}: 130 kts.		
	Straight ahead	24.25	23.25
	left turn – 30 degrees bank - neutral pedal	23.75	23.5
	right turn – 30 degrees bank - neutral pedal	24.25	23.75

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.

Climb Flight

- steady climb	55 kts		
	Manifold Pressure: 20.5		
	straight ahead	24.5	26.75
	left turn – 30 degrees bank - neutral pedal	23.75	27.25
	right turn – 30 degrees bank - neutral pedal	24.25	26.0

55 kts, Max Continuous Power

Compass heading: 060°
Start Altitude: 750 ft. ASL
End Altitude: 1,750 ft. ASL
Start time: 11:00
End time: 11:42
Elapsed time to climb: 0 min 42 seconds

Calculated rate of climb: 1,429 ft./min.

55 kts, Mx Continuous Power
Compass heading: 240°
Start Altitude: 800 ft. ASL
End Altitude: 1,800 ft. ASL
Start time: 13:03
End time: 13:37
Elapsed time to climb: 0 min 34 seconds
Calculated rate of climb: 1,765 ft./min.

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.

Autorotation

Entry speed: 65 kts
Entry altitude: 1,900 ft. ASL
Entry characteristics acceptable
Descent flight characteristics acceptable

Entry speed: 100 kts
Entry altitude: 1,300 ft. ASL
Entry characteristics acceptable
Descent flight characteristics acceptable

Flight with Right Skid Tube Mirror Installed

Configuration: As in baseline flight except that mirror installed

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	24.0	29.5
- sideward flight to 20 mph to right- adequate pedal remaining	25.0	30.0
- sideward flight to 20 mph to left – adequate pedal remaining	23.5	29.5
- backward flight to 20 mph - neutral pedal	24.0	30.0

Observations:

a) adequate control margins were maintained during each of the low speed flights.
b) there was no visual indication of vibration of either the mirror or the landing gear assembly.

Forward Flight

- cruise	55 kts		
	Manifold Pressure: 14.5 "Hg		
	Straight ahead	24.0	28.0
	left turn – 30 degrees bank - neutral pedal	24.0	27.75
	right turn – 30 degrees bank - neutral pedal	24.0	27.75
- cruise	70 kts		
	Manifold pressure: 18.0 "Hg		
	Straight ahead	24.5	26.75
	left turn – 30 degrees bank - neutral pedal	24.0	27.0
	right turn – 30 degrees bank - neutral pedal	24.4	26.75
- cruise	80 kts		
	Manifold Pressure: 18.7		
	Straight ahead	24.5	26.5
	left turn – 30 degrees bank - neutral pedal	24.5	27.0
	right turn – 30 degrees bank - neutral pedal	24.5	27.0
- cruise	90 kts		
	Manifold Pressure: 20.0 " Hg		
	Straight ahead	24.5	26.0
	left turn – 30 degrees bank - neutral pedal	24.5	26.25
	right turn – 30 degrees bank - neutral pedal	24.75	26.0

- cruise	100 kts		
	Manifold pressure: 22.0 "Hg		
	Straight ahead	24.25	25.0
	left turn – 30 degrees bank - neutral pedal	24.5	25.5
	right turn – 30 degrees bank - neutral pedal	24.5	25.5
- cruise	110 kts		
	Manifold pressure: 24.0 "Hg		
	Straight ahead	24.5	25.0
	left turn – 30 degrees bank - neutral pedal	24.25	25.5
	right turn – 30 degrees bank - neutral pedal	24.75	25.0
- cruise	115 kts (V_h)		
	Manifold pressure: 26.0 "Hg		
	Straight ahead	24.25	24.0
	left turn – 30 degrees bank - neutral pedal	24.5	24.5
	right turn – 30 degrees bank - neutral pedal	24.65	24.0
-cruise	Max continuous power descending to achieve V_{ne}		
	V_{ne}: 130 kts.		
	Straight ahead	24.0	23.5
	left turn – 30 degrees bank - neutral pedal	23.75	23.75
	right turn – 30 degrees bank - neutral pedal	24.5	23.5
	From BASELINE flight (see previous):		
	Max continuous power		
	Alt: 1,200 ft. ASL descending to achieve V_{ne}		
	V_{ne}: 130 kts.		
	Straight ahead	24.25	23.25
	left turn – 30 degrees bank - neutral pedal	23.75	23.5
	right turn – 30 degrees bank - neutral pedal	24.25	23.75

Longitudinal stick position approximately the same at V_{ne} with Mirror installed and the Mirror not installed. No substantial increase in drag resulting in additional mast bending considerations.

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.
c) there was no visual indication of vibration of either the mirror or the landing gear assembly.

Climb Flight

- steady climb	55 kts		
	Manifold Pressure: 20.5		
	straight ahead	24.0	26.5
	left turn – 30 degrees bank - neutral pedal	24.0	27.0
	right turn – 30 degrees bank - neutral pedal	24.0	26.25

55 kts, MCP

Compass heading: 320°
Start Altitude: 500 ft. ASL
End Altitude: 1,500 ft. ASL
Start time: 17:10
End time: 17:49
Elapsed time to climb: 0 min 39 seconds
Calculated rate of climb: 1,538 ft./min.

55 kts, MCP

Compass heading: 120°
Start Altitude: 500 ft. ASL
End Altitude: 1,500 ft. ASL
Start time: 20:07
End time: 20:42
Elapsed time to climb: 0 min 35 seconds
Calculated rate of climb: 1,714 ft./min.Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.
c) there was no visual indication of vibration of either the Mirror or the landing gear assembly.

Flight Demonstration Speed

-cruise Max continuous power
Alt: 2,400 ft. ASL descending to achieve V_d
V_d: 145 kts. achieved
straight ahead
left turn – 30 degrees bank demonstrated
right turn – 30 degrees bank demonstrated

Autorotation

Entry speed: 60 kts
Entry altitude: 2,000 ft. ASL

Stick position during descent 26.5 29.0
Entry characteristics acceptable
Descent flight characteristics acceptable

Entry speed: 85 kts
Entry altitude: 1,400 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

Entry speed: 110 kts
Entry altitude: 1,500 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

General Notes:

Stick pressures remained positive throughout all flights.

No unusual flight characteristics were observed.

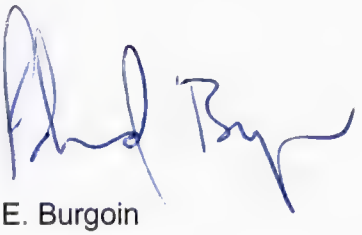
No conditions of vibration or flutter were observed on either the mirror or landing gear skid tube on which it was mounted.

Stick position measurements: Stick position laterally and longitudinally measured by small, light tape measures secured to the rotocraft control column and the loose end of the tape secured to the rotorcraft instrument console (longitudinal) and left hand door post (lateral). The measurements are arbitrary and can only be used for comparison purposes. The measurements taken between the central stick column and the LH door post for lateral position and between the central stick column and the instrument panel for the longitudinal position. The lateral measurement is taken such that an increasing number indicates stick moved to the right. The longitudinal measurement is taken such that an increasing number indicates stick moved aft.

Pilot: 

Ed Wilcock

Date: 02 February 2006

Witness: 

E. Burgoin

Date: 02 February 2006

Transport Canada / Transports Canada

SPECIAL FLIGHT PERMIT / PERMIS DE VOL SPÉCIAL

Name of Air Operator - Nom de l'exploitant aérien	Flight Permit Authorization No. - N° d'autorisation du permis de vol
E & B Helicopters Ltd.	2

Aircraft Manufacturer - Constructeur de l'aéronef	Model - Modèle	Serial No. - N° de série	Nationality and Registration Marks - Marques de nationalité et d'immatriculation
Robinson	R 44	0751	C-GFSZ

Aircraft does not meet the applicable airworthiness requirements for the following reasons: / L'aéronef ne satisfait pas aux exigences de navigabilité en vigueur pour les raisons suivantes

Installation of Mirror that requires flight testing to complete design certification.

A ferry flight is authorized to a base where maintenance can be carried out according to the following itinerary. / Un vol de convoyage est autorisé à une base où des travaux d'entretien peuvent être exécutés, selon le trajet suivant :

From - De	To - À	Date (Y-A/M/D-J)
Campbell River	Local	2006-01-30

Intermediate stops (if any) - Escales intermédiaires, le cas échéant :

As required for flight testing for 90 days.

Action to be taken prior to flight - Mesures à prendre avant le vol :

Logbook entry that installation is IAW Aero Design drawings 64901 and the aircraft is safe for flight.

THIS FLIGHT SHALL BE SUBJECT TO THE FOLLOWING STANDARD OPERATING LIMITATIONS

1. Essential crew members only - No passengers.
2. Permission of foreign civil aviation authority required prior to flight over their territory.
3. Where, by virtue of damage or unserviceability, performance of the aircraft is in any way degraded, air traffic control is to be advised both in the flight plan and on initial contact.
4. Flight is limited to VMC [✓] Yes [ ] No

CE VOL EST SOUMIS AUX CONDITIONS D'EXPLOITATION NORMALISÉES SUIVANTES :

1. Membres d'équipage essentiels seulement - pas de passagers.
2. Obtenir l'autorisation des autorités de l'aviation civile étrangères avant d'effectuer un vol au-dessus de leur territoire.
3. Lorsque, en raison de dommages ou du mauvais état de l'aéronef, le rendement de ce dernier est d'une quelconque façon diminué, il faut en informer les services de contrôle de la circulation aérienne dans le plan de vol et au moment du contact initial.
4. Le vol est limité à VMC [ ] Oui [ ] Non

FLIGHT SHALL BE OPERATED IN COMPLIANCE WITH THE FOLLOWING SPECIAL OPERATING LIMITATIONS:

LE VOL DOIT ÊTRE RÉALISÉ CONFORMÉMENT AUX CONDITIONS D'EXPLOITATION PARTICULIÈRES SUIVANTES :

- No flight over built up areas. VNE 1.1 X RFM VNE
- Flight is to follow Flight Test Plan FTP 649.02 Rev. 1 for the Cargo mirror

PRINT NAME / REMPLIR EN CARACTÈRES D'IMPRIMERIE

Safe for ferry statement has been entered in the Journey Log by / L'attestation que l'aéronef est en état d'effectuer le vol de convoyage a été inscrite dans le carnet de route par ▶

Flight under above limitations has been authorized by / Le vol en vertu des limites susmentionnées a été autorisé par ▶ Ted Bergoin/Greg Oucharek

Form prepared by (if other than person signing below) / Formule établie par (si autre que le soussigné) ▶ N/A

Signature of Authorized Person - Signature de la personne autorisée: John Dystensen

Date (Y-A/M/D-J): 2006-01-30

DEPARTMENT OF TRANSPORT - MINISTÈRE DES TRANSPORTS - Civil Aviation Safety Inspector 0598 Canada

24-0007 (0305-03)

1 ORIGINAL - FLIGHT LOG / - CARNET DE VOL 2 OPERATOR'S RECORD / DOSSIER DE L'EXPLOITANT 3 TRANSPORT CANADA / TRANSPORTS CANADA

Canada

Transport Canada / Transports Canada

SPECIAL FLIGHT PERMIT / PERMIS DE VOL SPÉCIAL

Name of Air Operator - Nom de l'exploitant aérien	Flight Permit Authorization No. - N° d'autorisation du permis de vol
E & B Helicopters Ltd.	1

Aircraft Manufacturer - Constructeur de l'aéronef	Model - Modèle	Serial No. - N° de série	Nationality and Registration Marks - Marques de nationalité et d'immatriculation
Robinson	R 22	3730	C-FBXP

Aircraft does not meet the applicable airworthiness requirements for the following reasons: / L'aéronef ne satisfait pas aux exigences de navigabilité en vigueur pour les raisons suivantes :

Installation of Bear Paws and Mirror that requires flight testing to complete design certification.

A ferry flight is authorized to a base where maintenance can be carried out according to the following itinerary: / Un vol de convoyage est autorisé à une base où des travaux d'entretien peuvent être exécutés, selon le trajet suivant :

From - De	To - À	Date (Y-A/M/D-J)
Campbell River	Local	2006-01-30

Intermediate stops (if any) - Escales intermédiaires, le cas échéant :

As required for flight testing for 90 days from issue.

Action to be taken prior to flight - Mesures à prendre avant le vol :

Logbook entry that installation is IAW Aero Design drawings 64002 and 64902 and the aircraft is safe for flight.

THIS FLIGHT SHALL BE SUBJECT TO THE FOLLOWING STANDARD OPERATING LIMITATIONS

1. Essential crew members only - No passengers.
2. Permission of foreign civil aviation authority required prior to flight over their territory.
3. Where, by virtue of damage or unserviceability, performance of the aircraft is in any way degraded, air traffic control is to be advised both in the flight plan and on initial contact.
4. Flight is limited to VMC [✓] Yes [ ] No

CE VOL EST SOUMIS AUX CONDITIONS D'EXPLOITATION NORMALISÉES SUIVANTES :

1. Membres d'équipage essentiels seulement - pas de passagers.
2. Obtenir l'autorisation des autorités de l'aviation civile étrangères avant d'effectuer un vol au-dessus de leur territoire.
3. Lorsque, en raison de dommages ou du mauvais état de l'aéronef, le rendement de ce dernier est d'une quelconque façon diminué, il faut en informer les services de contrôle de la circulation aérienne dans le plan de vol et au moment du contact initial.
4. Le vol est limité à VMC [ ] Oui [ ] Non

FLIGHT SHALL BE OPERATED IN COMPLIANCE WITH THE FOLLOWING SPECIAL OPERATING LIMITATIONS:

LE VOL DOIT ÊTRE RÉALISÉ CONFORMÉMENT AUX CONDITIONS D'EXPLOITATION PARTICULIÈRES SUIVANTES :

-No flight over built up areas.
-VNE 1.2 X VNE quoted in flight manual
-Flight is to follow flight test plan FTP 640.03 Rev 1 for Bear Paws and FTP 649.02 Rev 1 for Cargo mirror.

PRINT NAME / REMPLIR EN CARACTÈRES D'IMPRIMERIE

Safe for ferry statement has been entered in the Journey Log by / L'attestation que l'aéronef est en état d'effectuer le vol de convoyage à été inscrite dans le carnet de route par ▶

Flight under above limitations has been authorized by / Le vol en vertu des limites susmentionnées a été autorisé par ▶ Ted Bergoin/Greg Oucharek

Form prepared by (if other than person signing below) / Formule établie par (si autre que le soussigné) ▶ N/A

Signature of Authorized Person - Signature de la personne autorisée: Tom Ostensen

Date (Y-A/M/D-J): 2006-01-30

TRANSPORT - MINISTÈRE DES TRANSPORTS Civil Aviation Safety Inspector 0598 Canada Inspecteur de la sécurité de l'aviation civile

1 ORIGINAL - FLIGHT LOG - CARNET DE VOL
2 OPERATOR'S RECORD - DOSSIER DE L'EXPLOITANT
3 TRANSPORT CANADA - TRANSPORTS CANADA

Canada

Y/A M/M D/J	Pilot / Copilot Pilote / Copilote	From De	To À	Up Décollage	Down Atterissage	Air time Temps-air	TTSN**	9	10
	Totals brought forward Totaux reportés						712.4		
DEC 29/05	SEE DAILY F.S.	CCR6	CCR6	1100	1500	3.2	715.5		
DEC 30/05	SEE DAILY F.S	CCR6	CCR6	1100	1500	2.2	717.7		
JAN 01/06	SEE DAILY FS					5.8	723.5		
JAN 03/06	SEE DAILY FS					3.2	726.7		
JAN 5 2006	SEE DAILY F.S					3.6	730.3		
JAN 6 2006	SEE DAILY F.S					2.4	732.7		
JAN 15 2006	SEE DAILY F.S					5.6	738.3		
JAN 14 2006	SEE DAILY F.S					6.0	744.3		
JAN 15 2006	SEE DAILY FS					0.1	744.4		
JAN 19 2006	SEE DAILY FS.					2.5	750.9		
JAN 20 2006	SEE DAILY FS					5.5	758.4		
JAN 23 06	TIME CORRECTION FOR DEC 29/05					+ 0.1	758.5		
JAN 21 2006	SEE DAILY FS					1.2	759.7		
JAN 22 2006	SEE DAILY FS					1.6	761.3		
JAN 24 2006	SEE DAILY F.S					.9	762.2		
JAN 24/06	CCR6								

E & B Helicopters LTD. RS Number W.O # 3080 Log Entry - 1/24/06
C-FBXP Tach Time 762.2 Total Time 762.2

AMO 215-91

50 Hr Oil Change carried out. Replaced oil filter p/n CH48108-1 and serviced engine with 5l of Phillips 20w50 oil. A/C ground run and leak check carried out serviceable.

The maintenance described above has been performed IAW the applicable standards of airworthiness

Jan 24/06 DATE — SIGNATURE — M715747 LICENCE #

JAN 24 2006	SEE DAILY F.S.					3.0	765.2		
JAN 25 2006	SEE DAILY F.S.					1.0	766.2		
JAN 26 2006	SEE DAILY F.S.					1.5	767.7		
JAN 27 2006	SEE DAILY F.S.					2.6	770.3		

E & B Helicopters LTD. RS Number W.O.# 3092 Log Entry - 2/2/06
C-FBXP Tach Time 770.3 Total Time 770.3

AMO 215-91

Bear paws P/N 64001-01 installed IAW Aero Design drawing 64002.
Weight and balance calculated for experimental test flight by pilot.

The maintenance described above has been performed in accordance with the applicable standards of airworthiness.

02 Feb 2006 DATE — SIGNATURE — M432782 LICENCE NO.

15 → (Brought forward) (Reporté)

Next scheduled maintenance:
Prochaine maintenance planifiée: ..... Due:
Échéance: ..... (hr / cycles / d
(h / cycles / da

*Delete where inapplicable — Supprimer si ce n'est pas applicable

**Total time since new — Temps total depuis

JOURNEY – *ROUTE*		CREW – *ÉQUIPAGE*	RECORD OF TIME – *FICHE DE TEMPS*					
1. DATE	2. POINT OF DEPARTURE AND DESTINATION / *POINT DE DÉPART ET DESTINATION*	3. NAME/S – *NOM/S*	4. UP / *QUITTE LE SOL À*	5. DOWN / *PRISE DE CONTACT*	6. AIR TIME / *TEMPS DANS LES AIRS*	FLIGHT TIME / *TEMPS DE VOL*	7. TOTAL AIR TIME SINCE MANUFACTURE / *TEMPS AIR TOTAL DEPUIS SA CONSTRUCTION*	8. TOTAL NUMBER OF PERS ON BOARD / *NOMBRE DE PERSONNES À B*
16JAN06	TOTAL BROUGHT FORWARD / *TOTAL REPORTÉ*						1387.7	NUMBER / *NOMBRE* WE

E & B Helicopters LTD. RS Number W.O.# **2279** Log Entry - **11/7/05**
C-GFSZ **Tach Time** 1387.7 **Total Time** 1387.7
AMO 215-91

100 hr inspection carried out I.A.W RHC MM chap. 2.400
Removed NPX138FM p/n NPX138-000 s/n 1227.
Removed GPS-Handheld p/n 295 s/n 98829810.
Removed regulated power booster model RB-125 s/n 3513
Removed VHF antenna p/n CI177-1 s/n 9921.
SB-55 Fuel control reorientation. SB-55 complied with not applicable by a/c model.
Engine s/n L-25558-40A removed to compliy with Lyc. SB566.
Lyc SB566 cranckshaft replacement. SB566 complied with by LYCOMING TEXTRON WO# C6X25558.
AD2005-19-11 Cranckshaft replacement. complied with I.A.W SB566.
CF 90-03R2 Heater insp. AD part I complied with no defect found.
SL24 Blade tip insp. Blade tips inspected as per SL-24 no defect found.
TCM SB653 Hot mag test. SB 653 complied with no defect found.
TCM SB636 Ignition switch. SB 636 complied with no defect found.
Lyc SB 528 Distributor gear insp. SB 528 complied with no defect found.
Lyc. SB515/TCM643 mag timing.Both mags timed to engine at 25 degrees BTDC.
Lyc. SB 480E engine oil change. SB 480 complied with engine oil drained and replenished with 8L of PHILLIPS Mineral 20W50 oil. Oil filter removed inspected no metal particles found, new CH48103 filter installed.
AD2003-24-51/SB51 Bolts inspection. AD and SB complied with N?A by A/C S/N.
AD CF1996-09R1 Flight limitation. AD complied with flight limitation removed from POH.
AD CF98-15 External rescue system. AD complied with not applicable by A/C model.
AD F-2005-023 Engines overhauled by Provence aero maintenance. AD complied with N/A engine hasn't been overhauled yet.
AD2005-26-10 ECi cylinder assy p/n AEL65102. AD not applicable engine hasn't been through an overhaul or major repair on the cylinders.
AD 2005-12-06 Reduce insp. on impulse coupling mags. AD complied with N/A by Mag coupling type.
AD 2004-10-14 Crankshaft gear retaining bolt. AD complied with by LYCOMING TEXTRON under WO# C6X25558.
AD 2004 -05-24 Crankshaft retaining bolt. AD complied with N/A by engine S/N.
AD CF2005-40 Non conformance of maintenance engine. AD complied with Log book reviewed engine s/n L-25558-40A installed in a/c s/n 0751 has not been overhaul or repaired by B.C. Aero Engines LTD.
SB-48 Fuel control safety wire. SB complied with N/A by a/c model.
SB-50 Oil line clamp. SB complied with N/A by a/c model.
SB 51 NAS6605-31 bolts. SB complied with N/A by a/c serial number.
Removed Bear Paws
Removed cargo mirror
Engine s/n L-25558-40A installed I.A.W RHC MM chap.6.120.
Clutch sheave alignment carried out I.A.W RHC MM chap. 7.230.
Intermediate flex plate shimming carried out I.A.W RHC MM chap.7.330.
Fan balance carried out 0.12 IPS
M/R track and balance carried out serviceable within limits of 3/8 " though all airspeed I.A.W RHC MM chap. 10.230.
Autorotation adjustment carried out serviceable within limits I.A.W RHC chap. 10.250 figure 10-15.
Weight and balance amendment in error. New W&B report computed with cargo hook installation only.
New empty weight 1467.40 new CG 106.77

Ground run and leak check carried out serviceable.

Engine oil drained and replenished with 8L PHILLIPS mineral 20W50 oil after first ground run.

The maintenance described above has been performed in accordance with the applicable standards of airworthiness.
DATE SIGNATURE LICENCE NO M795407

Inspection for conformance to the type of flight & power plant controls affected by the work accomplished.
JAN16/06 DATE SIGNATURE LICENCE NO. M472301

JAN 17/06	CCR6	SPIZAWKA	1387.7	1389.5	1.8		1389.5
JAN 20/06	CCR6	SPIZAWKA	1389.5	1392.0	3.5		1392.0
JAN 24/06	CCR6	SPIZAWKA	1392.0	1393.0	1.0		1393.0
JAN 25/06	CCR6	SPIZAWKA/MESSMER			1.0		1394.0
JAN 25/06	CCR6	MESSMER/SPIZAWKA			1.0		1395.0

E & B Helicopters LTD. RS Number W.O.# **3093** Log Entry - **2/2/06**
C-GFSZ **Tach Time** 1395.0 **Total Time** 1395.0
AMO 215-91

Cargo mirror p/n 64920-01 installed IAW Aero Design drawing 64901.
Weight and balance calculated for experimental test flight by pilot.

The maintenance described above has been performed in accordance with the applicable the standards of airworthiness.
02 Feb 2006 DATE SIGNATURE M432182 LICENSE NO

TOTAL THIS PAGE / *TOTAL DE CETTE PAGE* 1395.0

AERO Design Ltd.

FLIGHT TEST PLAN

FTP 649.02

Mirror Installation

Robinson R-22, R-44

Revision 2
15 February, 2006

AERO Design Ltd.
Engineering Consultants

2013 – 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333
E-Mail: aerodesign@telusplanet.net

Emailed to Greg / Serge Mar 3/06

TABLE OF CONTENTS

1.0 INTRODUCTION

A mirror is installed on the front end of the skid tube to improve visibility of cargo slung under the helicopter.

2.0 REFERENCE

Rotorcraft Flight Manual, Robinson R22

Rotorcraft Flight Manual, Robinson R44

Aero Design Ltd. Installation Drawing 64901 and 64902, Mirror Installation.

3.0 BASIS OF CERTIFICATION

R22, R22 Alpha, R22 Beta, R22 Mariner

Type Certificate H10WE

FAR 27, including Amendment 27-10.

R44 and R44-II

Type Certificate H11NM granted December 10, 1992.

FAR 27, including Amendment 27-24.

This flight test programme will demonstrate that the installation of the Mirror complies with the flight requirements of the original basis of certification.

4.0 FLIGHT TEST PREPARATION

4.1 General

The flight crew should review and be familiar with the regulatory requirements of FAR 27 Subpart B - Flight prior to conducting flight tests. These requirements are included as Appendix C.

The flight crew should examine and be familiar with the modification installed including a review of the proposed Flight Manual Supplement (if any).

The relative cyclic stick position in the various flight conditions is to be determined by attaching light retracting type tape measures between the cyclic stick and the airframe in both the longitudinal and lateral directions.

Test points must be flown accurately allowing the aircraft to stabilize before data is recorded.

Each limiting condition should be approached with caution, using an incremental build-up approach.

The flight crew should always be attentive to unusual noises, vibrations, control characteristics, attitudes and instrument indications.

4.2 Configuration

Baseline flight

The helicopter shall be in the same configuration as flown for the modification flight test except that the external portions of the modification shall be removed. The helicopter shall be ballasted to obtain the same gross weight and centre of gravity as flown for the modification flight test.

Modification flight test

Those components of the modification which alter the external profile of the aircraft shall be installed in accordance with the applicable installation drawings.

Any other unusual or particularly large external modifications should be removed if practical and all external modifications installed during flight testing should be noted in the flight test report.

The aircraft is to be ballasted to its maximum gross weight.

4.3 Flight Authority

The Certificate of Airworthiness may not be valid after the modification has been installed. Flight Authority in the form of a flight permit may be required.

Flight authority to exceed the published V_{ne} of the helicopter is required. When the V_{ne} for the modification as provided in the proposed Flight Manual Supplement does not restrict the maximum speed to less that 90% of the basic helicopter V_{ne} then, the flight permit should specifically state that a higher V_{ne} is authorized.

4.4 Definitions

Stability: It shall be possible to fly the helicopter in normal maneuvers for a continuous period of time appropriate to the operational use of the particular type of helicopter without the pilot experiencing undue fatigue or strain.

Static longitudinal stability: The characteristics of the longitudinal cyclic control shall be such that, with constant throttle and collective pitch settings, a rearward displacement of the longitudinal control shall be necessary to obtain and maintain speeds below the specified trim speed, and a forward displacement shall be necessary to obtain and maintain speeds above the specified trim speed.

Adequate control margins: There is adequate control and stick movement available from the position at the trim speed to the control stops or other obstructions to stick movement to safely control the helicopter.

5.0 FLIGHT TEST PROCEDURE

5.1 Flight Characteristics

Controllability Stability Flutter and Vibration

FAR 27.141, 27.143, 27.171, 27.177 and 27.629

Low Speed

FAR 27.141(b), 27.143(a), 27.143(c), 27.171, 27.175(d) and 27.629

Hover in a fixed position at a skid height of approximately 5 – 15 ft above the ground

Translate in both sideward directions and in a rearward direction into the prevailing wind until airspeed estimated to be 17 knots (20 mph) has been reached.

Record:
- adequate control margins
- Relative lateral and longitudinal stick position (tape measurement)
- Observe and record any indications of flutter or vibrations

Climb

FAR 27.141(b), 27.143(a), 27.171, 27.175(a), 27.177 and 27.629

At the recommended climb speed, V_y, from the Basic Flight Manual increase power slowly until reaching Maximum Continuous Power

Make a 30° bank turn to the left and to the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Qualitative assessment of directional stability
- Observe and record any indications of flutter or vibrations

Level Flight

FAR 27.141(b), 27.143(a), 27.171, 27.175(b), 27.177, and 27.629

Transition from hover to forward flight increasing the speed incrementally in 10 mph steps until Maximum Continuous Power is being applied, or V_{ne} from the proposed Flight Manual Supplement is reached, whichever is less.

At each speed increment make a 30° bank turn to the left and the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Qualitative assessment of directional stability
- Observe and record any indications of flutter or vibrations

R44: In the basic Flight Manual, V_{ne} is 130 KIAS up to 2200 pounds, and 120 KIAS above.

R22: In the basic Flight Manual, V_{ne} is 98 KCAS.

At Maximum Continuous Power, V_h, or V_{ne} from the proposed Flight Manual Supplement, whichever is less

FAR 27.143(a)

Record:
- stable airspeed, V_h
- record if V_{ne} was reached prior to applying MCP

Continue to accelerate the aircraft in 10 mph increments by maintaining Maximum Continuous Power and descending as necessary V_{ne} is reached.

FAR 27.143(b) and 27.629

At each speed increment make a 30° bank turn to the left and to the right

At V_{ne} ensure there are adequate control margins and adequate pitch control

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

For the flight test with modification installed only

Compare the longitudinal stick position (as measured with the measuring tape attached to the cyclic stick) for modification installed flight test to the position obtained in the baseline flight at V_{ne} this point. If the longitudinal stick position is further forward at V_{ne} with the modification installed (basic helicopter V_{ne} or proposed Flight Manual Supplement V_{ne}, whichever is less) than was determined during the baseline flight at V_{ne} then it may be necessary to further limit the V_{ne} with the modification installed due to mast bending considerations.

Applying power as required, and further descending the helicopter if necessary, cautiously accelerate the helicopter until the longitudinal cyclic stick position is in the same location as was determined in the baseline flight at V_{ne} from the basic helicopter Flight Manual.

Record:
- speed at which, for the modification installed, longitudinal cyclic stick position is in the same location as was determined in the baseline flight at the V_{ne}.

Autorotation

FAR 27.141(b), 27.143(a)(v), 27.143(d), 27.175(c) and 27.629

At each of V_y, normal cruise speed and V_h, from level flight (if possible) simulate a sudden engine failure by rapidly retarding the throttle to the idle position. The collective stick must be kept in the power-on position for at least one (1) second after the throttle is retarded before any response is made.

Record:
- assess that autorotation entry characteristics not changed from basic aircraft
- observe and report any unusually rapid rotor speed decay.
- For entry speed at V_h, adequate pitch and roll control

During descent, vary forward speed between 50% $V_{min\ rate\ of\ descent}$ and $V_{ne\ autorotation}$, making gentle turns to the left and to the right.

Record:
- adequate control margins
- unusual pitch, roll or yaw rates
- observe and record any indications of flutter or vibrations

5.2 Performance

FAR 27.65(b)

If the external modification is of significant size and shape as to affect the climb performance of the helicopter the following procedure shall be included in the flight test.

On a compass heading at 90° to the local wind conditions, from level flight at the recommended climb speed, V_y, increase power to Maximum Continuous Power maintaining airspeed. When a steady rate of climb is established, note the altimeter reading and measure the time to climb through an altitude of 1000 ft.

Record:
- Starting altitude
- Time to climb through 1000 ft.

Repeat the above procedure on the reciprocal compass heading starting at the same altitude

Record:
- Starting altitude
- Time to climb through 1000 ft.

5.3 Flight at Demonstration Speed

FAR 27.629, 27.309 and 27.1505(a)

Caution: The rotorcraft should be maneuvered gently above V_{ne}

The aircraft should be accelerated slowly above V_{ne} to ensure the target airspeed is not passed.

Applying Maximum Continuous Power and descending the aircraft as required, cautiously accelerate the aircraft to 1.11 times V_{ne}

Make a 30° bank turn to the left and the right

Record:
- maximum airspeed attained
- observe and record any indications of flutter or vibrations

R44: In the basic Flight Manual, V_{ne} is 130 KIAS below 2200 pounds, therefore V_d must not exceed 144 KIAS.

At weights above 2200 pounds, V_{ne} is 120 KIAS, hence V_d may not exceed 133 KIAS.

R22: In the basic Flight Manual, V_{ne} is 98 KCAS, therefore V_d must not exceed 109 KCAS

5.4 Take off and Landing

FAR 27.51(a)(1), 27.75(a)(1) and 27.231

With the modification installed, perform a landing on soft ground. Observe for tendency of the installation to stick or catch in the soft ground, or any other condition that may create a hazard.

Take off from soft ground. Observe for tendency of the installation to stick or catch in the soft ground, or any other condition that may create a hazard.

5.5 Other Observations

Effect of modification on normal and emergency procedures

Record: - Comment

Effect of modification on normal and emergency egress

Record: - Comment

Evaluation of modification Flight Manual Supplement

Record: - Comment

APPENDIX A

FLIGHT TEST REPORT

ROBINSON R22

Aircraft: C-FBXP
Robinson R22, Serial no. 3730

02 February 2006
Location: Campbell River BC

Configuration: 1370 lbs. at take-off (max. gross weight for V_{ne} at 102 KIAS.)
CG at 95.64 (limited by fuel and occupant location – no additional ballast)
Bear Paws not installed.
No other external modifications installed on the aircraft.

Crew: Pilot: Ed Wilcock, E & B Helicopters
DAR: Ted Burgoin, Aero Design Ltd.

Base Line Flight without either: BearPaws installed
Right Skid Tube Mirror

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	21.25	29.75
- sideward flight to 20 mph to right	22.0	29.5
- sideward flight to 20 mph to left	20.75	29.5
- backward flight to 20 mph	21.5	30.25

Observations:

a) adequate control margins were maintained.

Forward Flight

- cruise	60 kts -- Manifold Pressure	16.8 "Hg	
	straight ahead	22.0	26.5
	left turn – 30 degrees bank	23.0	26.75
	right turn – 30 degrees bank	22.5	26.5
- cruise	70 kts -- Manifold Pressure	16.8 "Hg	
	Straight ahead	23.0	26.25
	left turn – 30 degrees bank	22.5	26.5
	right turn – 30 degrees bank	23.0	26.5
- cruise	80 kts -- Manifold Pressure	18.0 "Hg	
	Straight ahead	23.0	26.0
	left turn – 30 degrees bank	23.0	25.75
	right turn – 30 degrees bank	23.0	26.0
- cruise	90 kts -- Manifold Pressure	20.5 "Hg	

	Straight ahead	23.0	25.0
	left turn – 30 degrees bank	23.25	25.0
	right turn – 30 degrees bank	23.25	25.0
- cruise	Max continuous power -- Manifold Pressure	24.0 "Hg	
	Alt: 1,000 ft. ASL		
	V_h: 95 kts.		
	Straight ahead	23.5	24.25
	left turn – 30 degrees bank	23.5	24.25
	right turn – 30 degrees bank	24.0	24.0
-cruise	Max continuous power		
	Alt: 1,500 ft. ASL descending to achieve V_{ne}		
	V_{ne}: 102 kts.		
	Straight ahead	23.5	24.0
	left turn – 30 degrees bank	23.5	23.75
	right turn – 30 degrees bank	23.0	24.0

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.

Climb Flight

- steady climb	55 kts (V_y)		
	Manifold Pressure: 18 "Hg		
	straight ahead		
	left turn – 30 degrees bank	22.0	26.5
	right turn – 30 degrees bank	23.0	26.5

- Max Continuous Power	55 kts (V_y)		
	Manifold Pressure: 24 "Hg		
	straight ahead	21.75	27.0
	left turn – 30 degrees bank	23.5	26.5
	right turn – 30 degrees bank	23.25	26.5

Compass heading: 300°
Start Altitude: 800 ft. ASL
End Altitude: 1,800 ft. ASL
Start time: :50
End time: 1:37
Elapsed time to climb: 0 min 47 seconds
Calculated rate of climb: 1,277 ft./min.

Max Continuous Power 55 kts (V_y)

Compass heading: 120°
Start Altitude: 800 ft. ASL
End Altitude: 1,800 ft. ASL
Start time: :03
End time: 0:53
Elapsed time to climb: 0 min 50 seconds
Calculated rate of climb: 1,200 ft./min.

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.

Autorotation

Entry speed: 65 kts
Entry altitude: 1,800 ft. ASL

Stick position during descent	23.0	28.0
Entry characteristics acceptable		
Descent flight characteristics acceptable		

Entry speed: 95 kts, then slowed down thru 85, 80, 70, 65 kts.
Entry altitude: 1,950 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

Flight with Right Skid Tube Mounted Mirror Installed

Configuration: As in baseline flight except that the 6" diameter mirror was installed, bear paws not installed.

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	21.5	29.75
- sideward flight to 20 mph to right- adequate pedal remaining	22.0	29.25
- sideward flight to 20 mph to left – adequate pedal remaining	21.0	29.25
- backward flight to 20 mph - neutral pedal	21.5	30.0

Observations:

- adequate control margins were maintained during each of the low speed flights.
- there was no visual indication of vibration of either the mirror or the landing gear assembly.

Forward Flight

- cruise	60 kts Manifold Pressure: 16.3 "Hg		
	straight ahead	22.75	27.0
	left turn – 30 degrees bank - neutral pedal	22.75	26.5
	right turn – 30 degrees bank - neutral pedal	22.75	26.75
- cruise	70 kts Manifold Pressure: 16.5 "Hg		
	straight ahead	22.5	26.25
	left turn – 30 degrees bank - neutral pedal	22.5	26.5
	right turn – 30 degrees bank - neutral pedal	22.75	26.25
- cruise	80 kts Manifold Pressure: 18.0 "Hg		
	Straight ahead	22.75	25.5
	left turn – 30 degrees bank - neutral pedal	23.0	26.0
	right turn – 30 degrees bank - neutral pedal	23.25	26.0
- cruise	90 kts Manifold Pressure: 20.8 "Hg		
	Straight ahead	23.25	25.25
	left turn – 30 degrees bank - neutral pedal	23.0	25.25
	right turn – 30 degrees bank - neutral pedal	23.5	25.5

- cruise Max. continuous power
Manifold pressure: 24.0,
Engine RPM: 100%
V_h: 94 KIAS

Straight ahead	22.75	26.0
left turn – 30 degrees bank - neutral pedal	22.75	25.5
right turn – 30 degrees bank - neutral pedal	23.25	26.25

-cruise Max continuous power
Alt: 1,800 ft. ASL descending to achieve V_{ne}
V_{ne}: 130 kts.

Straight ahead	23.0	24.0
left turn – 30 degrees bank - neutral pedal	23.5	23.75
right turn – 30 degrees bank - neutral pedal	23.5	24.25

From BASELINE flight (see previous):
Max continuous power
Alt: 1,200 ft. ASL descending to achieve V_{ne}
V_{ne}: 130 kts.

Straight ahead	23.5	24.0
left turn – 30 degrees bank	23.5	23.75
right turn – 30 degrees bank	23.0	24.0

Longitudinal stick position approximately the same at V_{ne} with the Mirror installed and the Mirror not installed. No substantial increase in drag resulting in additional mast bending considerations.

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.
- there was no visual indication of vibration of either the mirror or the landing gear assembly.

Climb Flight

Maximum Continuous Power, 55 kts (V_y)

Compass heading: 030°
Start Altitude: 900 ft. ASL
End Altitude: 1,900ft. ASL
Start time: :45
End time: :35
Elapsed time to climb: 0 min 50 seconds
Calculated rate of climb: 1,200 ft./min.

Maximum Continuous Power, 55 kts (V_y)

Compass heading: 210°
Start Altitude: 850 ft. ASL
End Altitude: 1,850 ft. ASL
Start time: :25
End time: 1:17
Elapsed time to climb: 0 min 52 seconds
Calculated rate of climb: 1,154 ft./min.

Observations:

- adequate control margins were observed at each of the above listed flight speeds.
- positive longitudinal stability was observed at each flight speed.
- there was no visual indication of vibration of either the mirror or the landing gear assembly.

Flight Demonstration Speed

-cruise Max continuous power
Alt: 2,000 ft. ASL descending to achieve V_d
V_d: 115 kts. achieved
straight ahead
left turn – 30 degrees bank demonstrated
right turn – 30 degrees bank demonstrated
there was no visual indication of vibration of either the mirror or the landing gear assembly.

Autorotation

Entry speed: 60 kts
Entry altitude: 1,500ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable
there was no visual indication of vibration of either the mirror or the landing gear assembly.

Entry speed: 95 kts
Entry altitude: 1,400 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable
there was no visual indication of vibration of either the mirror or the landing gear assembly.

General Notes:

Stick pressures remained positive throughout all flights.

No unusual flight characteristics were observed.

Stick position measurements: Stick position laterally and longitudinally measured by small, light tape measures secured to the aircraft structure and the loose end of the tape secured to the stick. The measurements are arbitrary and can only be used for comparison purposes. The measurements taken between the central stick column and the LH door post for lateral position and between the central stick column and the instrument panel for the longitudinal position. The lateral measurement is taken such that an increasing number indicates stick moved to the right. The longitudinal measurement is taken such that an increasing number indicates stick moved aft.

Pilot: _____ Witness: _____

Ed Wilcock E. Burgoin

Date: 02 February 2006 Date: 02 February, 2006

ROBINSON R44

Aircraft: C-GFSZ
Robinson R44 , Serial no. 0751

02 February 2006
Location: Campbell River BC

Configuration: 2,162 lbs. at take-off
CG at 95.85 (limited by fuel and occupant location – no additional ballast)
Right Skid Tube Mirror not installed.
No other external modifications installed on the aircraft.

Crew: Pilot: Ed Wilcock, E & B Helicopters
DAR: Ted Burgoin, Aero Design Ltd.

Base Line Flight without Mirror installed

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	24.0	30.0
- sideward flight to 20 mph to right- adequate pedal remaining	25.25	29.5
- sideward flight to 20 mph to left – adequate pedal remaining	23.25	29.75
- backward flight to 20 mph - neutral pedal	24.0	29.5

Observations:

b) adequate control margins were maintained.

Forward Flight			
- cruise	55 kts Manifold Pressure: 14.75 "Hg		
	Straight ahead	24.25	27.75
	left turn – 30 degrees bank - neutral pedal	24.5	28.25
	right turn – 30 degrees bank - neutral pedal	24.5	28.0
- cruise	70 kts Manifold pressure: 17.75 "Hg		
	Straight ahead	24.25	27.0
	left turn – 30 degrees bank - neutral pedal	23.75	26.25
	right turn – 30 degrees bank - neutral pedal	24.75	27.25
- cruise	80 kts Manifold Pressure: 18.5 "Hg		
	Straight ahead	24.5	26.75
	left turn – 30 degrees bank - neutral pedal	24.0	26.75
	right turn – 30 degrees bank - neutral pedal	24.75	27.0

- cruise	90 kts		
	Manifold Pressure: 19.5 " Hg		
	Straight ahead	24.5	26.0
	left turn – 30 degrees bank - neutral pedal	24.5	26.0
	right turn – 30 degrees bank - neutral pedal	24.5	26.0
- cruise	100 kts		
	Manifold pressure: 22.2 "Hg		
	Straight ahead	24.25	25.0
	left turn – 30 degrees bank - neutral pedal	24.25	25.25
	right turn – 30 degrees bank - neutral pedal	24.25	25.25
- cruise	110 kts		
	Manifold pressure: 24.0 "Hg		
	Straight ahead	24.5	24.75
	left turn – 30 degrees bank - neutral pedal	24.5	25.25
	right turn – 30 degrees bank - neutral pedal	24.25	25.0
- cruise	117 kts (V_h)		
	Manifold pressure: 26.0 "Hg		
	Straight ahead	24.25	24.0
	left turn – 30 degrees bank - neutral pedal	24.25	24.25
	right turn – 30 degrees bank - neutral pedal	25.0	24.25
-cruise	Max continuous power		
	descending to achieve V_{ne}		
	V_{ne}: 130 kts.		
	Straight ahead	24.25	23.25
	left turn – 30 degrees bank - neutral pedal	23.75	23.5
	right turn – 30 degrees bank - neutral pedal	24.25	23.75

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.

Climb Flight

- steady climb	55 kts		
	Manifold Pressure: 20.5		
	straight ahead	24.5	26.75
	left turn – 30 degrees bank - neutral pedal	23.75	27.25
	right turn – 30 degrees bank - neutral pedal	24.25	26.0

55 kts, Max Continuous Power

Compass heading: 060°
Start Altitude: 750 ft. ASL
End Altitude: 1,750 ft. ASL
Start time: 11:00

End time: 11:42
Elapsed time to climb: 0 min 42 seconds
Calculated rate of climb: 1,429 ft./min.

55 kts, Mx Continuous Power
Compass heading: 240°
Start Altitude: 800 ft. ASL
End Altitude: 1,800 ft. ASL
Start time: 13:03
End time: 13:37
Elapsed time to climb: 0 min 34 seconds
Calculated rate of climb: 1,765 ft./min.

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.

Autorotation

Entry speed: 65 kts
Entry altitude: 1,900 ft. ASL
Entry characteristics acceptable
Descent flight characteristics acceptable

Entry speed: 100 kts
Entry altitude: 1,300 ft. ASL
Entry characteristics acceptable
Descent flight characteristics acceptable

Flight with Right Skid Tube Mirror Installed

Configuration: As in baseline flight except that mirror installed

Low Speed Controllability	Cyclic Stick Tape Position Lateral	Long.
- stationery hover	24.0	29.5
- sideward flight to 20 mph to right- adequate pedal remaining	25.0	30.0
- sideward flight to 20 mph to left – adequate pedal remaining	23.5	29.5
- backward flight to 20 mph - neutral pedal	24.0	30.0

Observations:

a) adequate control margins were maintained during each of the low speed flights.
b) there was no visual indication of vibration of either the mirror or the landing gear assembly.

Forward Flight

- cruise	55 kts		
	Manifold Pressure: 14.5 "Hg		
	Straight ahead	24.0	28.0
	left turn – 30 degrees bank - neutral pedal	24.0	27.75
	right turn – 30 degrees bank - neutral pedal	24.0	27.75
- cruise	70 kts		
	Manifold pressure: 18.0 "Hg		
	Straight ahead	24.5	26.75
	left turn – 30 degrees bank - neutral pedal	24.0	27.0
	right turn – 30 degrees bank - neutral pedal	24.4	26.75
- cruise	80 kts		
	Manifold Pressure: 18.7		
	Straight ahead	24.5	26.5
	left turn – 30 degrees bank - neutral pedal	24.5	27.0
	right turn – 30 degrees bank - neutral pedal	24.5	27.0
- cruise	90 kts		
	Manifold Pressure: 20.0 " Hg		
	Straight ahead	24.5	26.0
	left turn – 30 degrees bank - neutral pedal	24.5	26.25
	right turn – 30 degrees bank - neutral pedal	24.75	26.0

- cruise	100 kts		
	Manifold pressure: 22.0 "Hg		
	Straight ahead	24.25	25.0
	left turn – 30 degrees bank - neutral pedal	24.5	25.5
	right turn – 30 degrees bank - neutral pedal	24.5	25.5
- cruise	110 kts		
	Manifold pressure: 24.0 "Hg		
	Straight ahead	24.5	25.0
	left turn – 30 degrees bank - neutral pedal	24.25	25.5
	right turn – 30 degrees bank - neutral pedal	24.75	25.0
- cruise	115 kts (V_h)		
	Manifold pressure: 26.0 "Hg		
	Straight ahead	24.25	24.0
	left turn – 30 degrees bank - neutral pedal	24.5	24.5
	right turn – 30 degrees bank - neutral pedal	24.65	24.0
-cruise	Max continuous power		
	descending to achieve V_{ne}		
	V_{ne}: 130 kts.		
	Straight ahead	24.0	23.5
	left turn – 30 degrees bank - neutral pedal	23.75	23.75
	right turn – 30 degrees bank - neutral pedal	24.5	23.5
	From BASELINE flight (see previous):		
	Max continuous power		
	Alt: 1,200 ft. ASL descending to achieve V_{ne}		
	V_{ne}: 130 kts.		
	Straight ahead	24.25	23.25
	left turn – 30 degrees bank - neutral pedal	23.75	23.5
	right turn – 30 degrees bank - neutral pedal	24.25	23.75

Longitudinal stick position approximately the same at V_{ne} with Mirror installed and the Mirror not installed. No substantial increase in drag resulting in additional mast bending considerations.

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.
c) there was no visual indication of vibration of either the mirror or the landing gear assembly.

Climb Flight

- steady climb	55 kts		
	Manifold Pressure: 20.5		
	straight ahead	24.0	26.5
	left turn – 30 degrees bank - neutral pedal	24.0	27.0
	right turn – 30 degrees bank - neutral pedal	24.0	26.25

55 kts, MCP

Compass heading: 320°
Start Altitude: 500 ft. ASL
End Altitude: 1,500 ft. ASL
Start time: 17:10
End time: 17:49
Elapsed time to climb: 0 min 39 seconds
Calculated rate of climb: 1,538 ft./min.

55 kts, MCP
Compass heading: 120°
Start Altitude: 500 ft. ASL
End Altitude: 1,500 ft. ASL
Start time: 20:07
End time: 20:42
Elapsed time to climb: 0 min 35 seconds
Calculated rate of climb: 1,714 ft./min.

Observations:

a) adequate control margins were observed at each of the above listed flight speeds.
b) positive longitudinal stability was observed at each flight speed.
c) there was no visual indication of vibration of either the Mirror or the landing gear assembly.

Flight Demonstration Speed

-cruise Max continuous power
Alt: 2,400 ft. ASL descending to achieve V_d
V_d: 145 kts. achieved
straight ahead
left turn – 30 degrees bank demonstrated
right turn – 30 degrees bank demonstrated

Autorotation

Entry speed: 60 kts
Entry altitude: 2,000 ft. ASL

Stick position during descent	26.5	29.0
Entry characteristics acceptable		
Descent flight characteristics acceptable		

Entry speed: 85 kts
Entry altitude: 1,400 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

Entry speed: 110 kts
Entry altitude: 1,500 ft. ASL

Entry characteristics acceptable
Descent flight characteristics acceptable

General Notes:

Stick pressures remained positive throughout all flights.

No unusual flight characteristics were observed.

No conditions of vibration or flutter were observed on either the mirror or landing gear skid tube on which it was mounted.

Stick position measurements: Stick position laterally and longitudinally measured by small, light tape measures secured to the rotorcraft control column and the loose end of the tape secured to the rotorcraft instrument console (longitudinal) and left hand door post (lateral). The measurements are arbitrary and can only be used for comparison purposes. The measurements taken between the central stick column and the LH door post for lateral position and between the central stick column and the instrument panel for the longitudinal position. The lateral measurement is taken such that an increasing number indicates stick moved to the right. The longitudinal measurement is taken such that an increasing number indicates stick moved aft.

Pilot: _____ Witness: _____

Ed Wilcock E. Burgoin

Date: 02 February 2006 Date: 02 February 2006

APPENDIX B

WEIGHT AND BALANCE CALCULATIONS

Weight and Balance for Flight Test 02 February 2006

Right Skid Tube Mirror Installation – Robinson R22

Robinson R22

C-FBXP, Serial No. 3730

Item	Weight (lbs.)	Arm (inches)	Moment (lb-in)
Basic Helicopter	883	103.23	91177
Skid Tube Mirror Installation	0.5	35.6	17.8
Pilot	190	78	14,820
Passenger	210	78	16,380
Fuel			
Main - 1/2 full (108.6 lb. full)	54	115	6,245
Aux – ¼ full (103.8 full)	26	63	1,638
	1,364		130,278

C. G. = 130,278 / 1,364 = 95.51 inches

Gross Weight Limit: 1,370 lb.

Helicopter refueled between flights to specified fuel condition.

Weight and Balance for Flight Test 02 February 2006

Robinson R44

C-GFSZ, Serial No. 0751

Item	Weight (lbs.)	Arm (inches)	Moment (lb-in)
Basic Helicopter	1,467.4	106.77	156,674
Right Skid Tube Mirror Instn	0.5	35	17.5
Pilot	190	49.5	9,405
Passenger	210	49.5	10,395
Fuel			
Main	184	106	19,504
Aux	110	102	11,220
	2,162		207,216

C. G. = 207,216 / 2,162 = 95.85 inches

Gross Weight Limit: 2,400 lb.

Helicopter refueled between flights to full fuel condition.

APPENDIX C

FAR 27 REQUIREMENTS

Sec. 27.65 – Climb: All engines operating.

(a) For rotorcraft other than helicopters--
(1) The steady rate of climb, at V_Y, must be determined--
(i) With maximum continuous power on each engine;
(ii) With the landing gear retracted; and
(iii) For the weights, altitudes, and temperatures for which certification is requested; and
(2) [The climb gradient, at the rate of climb determined in accordance with paragraph (a)(1) of this section, must be either--]
(i) At least 1:10 if the horizontal distance required to take off and climb over a 50-foot obstacle is determined for each weight, altitude, and temperature within the range for which certification is requested; or
(ii) [At least 1:6 under standard sea level conditions.]
(b) Each helicopter must meet the following requirements:
(1) V_Y must be determined--
(i) For standard sea level conditions;
(ii) At maximum weight; and
(iii) With maximum continuous power on each engine.
(2) [The steady rate of climb must be determined--
(i) At the climb speed selected by the applicant at or below V_{NE};
(ii) Within the range from sea level up to the maximum altitude for which certification is requested;
(iii) For the weights and temperatures that correspond to the altitude range set forth in paragraph (b)(2)(ii) of this section and for which certification is requested; and
(iv) With maximum continuous power on each engine.]

Sec. 27.141 – Flight Characteristics: General.

The rotorcraft must--
[(a) Except as specifically required in the applicable section meet the flight characteristics requirements of this subpart--
(1) At the altitudes and temperatures expected in operation;]
(2) Under any critical loading condition within the range of weights and centers of gravity for which certification is requested;
(3) For power-on operations, under any condition of speed, power, and rotor r.p.m. for which certification is requested; and
(4) For power-off operations, under any condition of speed and rotor r.p.m. for which certification is requested that is attainable with the controls rigged in accordance with the approved rigging instructions and tolerances;
(b) Be able to maintain any required flight condition and make a smooth transition from any flight condition to any other flight condition without exceptional piloting skill, alertness, or strength, and without danger of exceeding the limit load factor under any operating condition probable for the type, including--
(1) Sudden failure of one engine, for multiengine rotorcraft meeting Transport Category A engine isolation requirements of Part 29 of this chapter; and
(2) Sudden, complete power failure, for other rotorcraft; and
(3) Sudden, complete control system failures specified in Sec. 27.695 of this Part; and
(c) Have any additional characteristic required for night or instrument operation, if certification for those kinds of operation is requested. Requirements for helicopter instrument flight are contained in Appendix B of this Part.

Sec. 27.143 – Controllability and maneuverability.

(a) The rotorcraft must be safely controllable and maneuverable--
(1) During steady flight; and
(2) During any maneuver appropriate to the type, including--
(i) Takeoff;
(ii) Climb;
(iii) Level flight;
(iv) Turning flight;
(v) Glide;
(vi) Landing (power on and power off); and
(vii) Recovery to power-on flight from a balked autorotative approach.
(b) The margin of cyclic control must allow satisfactory roll and pitch control at V_{NE} with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Power off (except for helicopters demonstrating compliance with paragraph (e) of this section) and power on.
(c) A wind velocity of not less than 17 knots must be established in which the rotorcraft can be operated without loss of control on or near the ground in any maneuver appropriate to the type (such as crosswind takeoffs, sideward flight, and rearward flight), with--
(1) Critical weight;
[(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Altitude, from standard sea level conditions to the maximum altitude capability of the rotorcraft or 7,000 feet, whichever is less.]
(d) The rotorcraft, after (1) failure of one engine in the case of multiengine rotorcraft that meet Transport Category A engine isolation requirements, or (2) complete engine failure in the case of other rotorcraft, must be controllable over the range of speeds and altitudes for which certification is requested when such power failure occurs with maximum continuous power and critical weight. No corrective action time delay for any condition following power failure may be less than--
(i) For the cruise condition, one second, or normal pilot reaction time (whichever is greater); and
(ii) For any other condition, normal pilot reaction time.
(e) For helicopters for which a V_{NE} (power-off) is established under Sec. 27.1505(c), compliance must be demonstrated with the following requirements with critical weight, critical center of gravity, and critical rotor r.p.m.:
(1) The helicopter must be safely slowed to V_{NE} (power-off), without exceptional pilot skill, after the last operating engine is made inoperative at power-on V_{NE}.
(2) At a speed of 1.1 V_{NE} (power-off), the margin of cyclic control must allow satisfactory roll and pitch control with power off.

Sec. 27.171 – Stability: General

The rotorcraft must be able to be flown, without undue pilot fatigue or strain, in any normal maneuver for a period of time as long as that expected in normal operation. At least three landings and takeoffs must be made during this demonstration.

Sec. 27.173 – Static longitudinal stability.

[(a) The longitudinal control must be designed so that a rearward movement of the control is necessary to obtain a speed less than the trim speed, and a forward movement of the control is necessary to obtain a speed more than the trim speed.
(b) With the throttle and collective pitch held constant during the maneuvers specified in Sec. 27.175(a) through (c), the slope of the control position versus speed curve must be positive throughout the full range of altitude for which certification is requested.
(c) During the maneuver specified in Sec. 27.175(d), the longitudinal control position versus speed curve may have a negative slope within the specified speed range if the negative motion is not greater than 10 percent of total control travel.]

Sec. 27.175 – Demonstration of static longitudinal stability.

(a) *Climb.* Static longitudinal stability must be shown in the climb condition at speeds from 0.85 V_Y to 1.2 V_Y, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Maximum continuous power;
(4) The landing gear retracted; and
(5) The rotorcraft trimmed at V_Y.
(b) *Cruise.* Static longitudinal stability must be shown in the cruise condition at speeds from 0.7 V_H or 0.7 V_{NE}, whichever is less, to 1.1 V_H or 1.1 V_{NE}, whichever is less, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power for level flight at 0.9 V_H or 0.9 V_{NE}, whichever is less;
(4) The landing gear retracted; and
(5) [The rotorcraft trimmed at 0.9 V_H or 0.9 V_{NE}, whichever is less.]
(c) *Autorotation.* Static longitudinal stability must be shown in autorotation at airspeeds from 0.5 times the speed for minimum rate of descent to V_{NE} or to 1.1 V_{NE} (power-off) if V_{NE} (power-off) is established under Sec. 27.1505(c), and with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power off;
(4) The landing gear--
(i) Retracted; and
(ii) Extended; and
(5) The rotorcraft trimmed at appropriate speeds found necessary by the Administrator to demonstrate stability throughout the prescribed speed range.
(d) *Hovering.* For helicopters, the longitudinal cyclic control must operate with the sense and direction of motion prescribed in Sec. 27.173 between the maximum approved rearward speed and a forward speed of 17 knots with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power required to maintain an approximate constant height in ground effect;
(4) The landing gear extended; and
(5) The helicopter trimmed for hovering.

Sec. 27.177 – Static directional stability.

[Static directional stability must be positive with throttle and collective controls held constant at the trim conditions specified in Sec. 27.175 (a) and (b). This must be shown by steadily increasing directional control deflection for sideslip angles up to $\pm 10°$ from trim. Sufficient cues must accompany sideslip to alert the pilot when approaching sideslip limits.]

CONFORMITY INSPECTION RECORD

Applicant	Aeronautical Product				Title of Change
	ACRO DESIGN LTD R22 MIRROR				R22 SKID TUBE MIRROR INST'N.
	Make	Model	Serial No.	Region	
	ROBINSON.	R22	3730		

Drawing No.	Applicant's Inspector Signature	Date	T.C. Inspection Signature	Date	Findings
64902	[signature]	02 Feb 2006	[signature]	02 FEB 2006	

APPLICANT'S ATTESTATION

I hereby confirm that the prototype installation for the subject

☒ MODIFICATION,

☐ REPAIR,

☐ TSO/AP-TC ARTICLE

is in conformity with the applicable installation drawing(s) listed above and that necessary ground tests have been carried out.
[Please check (✓) the applicable box.]

Additional Information:

Signature: [signature]

TC INSPECTION

☒ ACCEPTABLE

☐ UNACCEPTABLE

Remarks:

Signature: [signature]

CONFORMITY INSPECTION RECORD

Applicant	Aeronautical Product				Title of Change
	AERO DESIGN LTD R44 MIRROR				R44 SKID TUBE MIRROR INST'N
	Make	Model	Serial No.	Region	
	ROBINSON	R44	751		

Drawing No.	Applicant's Inspector Signature	Date	T.C. Inspection Signature	Date	Findings
64901	[signature]	02 Feb 2006	[signature]	02 FEB 2006	

APPLICANT'S ATTESTATION

I hereby confirm that the prototype installation for the subject

☒ MODIFICATION,

☐ REPAIR,

☐ TSO/AP-TC ARTICLE

is in conformity with the applicable installation drawing(s) listed above and that necessary ground tests have been carried out.
[Please check (✓) the applicable box.]

Additional Information:

Signature: [signature]

TC INSPECTION

☒ ACCEPTABLE

☐ UNACCEPTABLE

Remarks:

Signature: [signature]

Transport Canada
Civil Aviation

Transports Canada
Aviation civile

SEE ASC 142 IF T.C DOING FLIGHT TEST

AIRWORTHINESS NOTICE

CONFORMITY INSPECTION ASSOCIATED WITH APPLIANCE TYPE CERTIFICATION OR MODIFICATION/REPAIR APPROVAL PROJECTS

(This Airworthiness Notice supersedes AN No. B043 Edition 1, dated 24 April 1998.)

Purpose

The purpose of this notice is to explain the responsibilities of an applicant prior to requesting a conformity inspection associated with the prototype evaluation of a supplemental type certificate (STC), a limited supplemental type certificate (L/STC), a repair design certificate (RDC), a TSO and/or an appliance type certificate (AP-TC) installation. This revision is intended to clarify the qualifications for those persons responsible for the conformity inspections.

Background

In several cases, prototype installations have not been performed in accordance with the applicant's installation drawings nor have the necessary ground tests been conducted, where required, prior to seeking a conformity inspection by Transport Canada (TC). This situation may often result in ineffective use of TC resources.

Conformity Requirements (Prototype Installation)

The need for a conformity inspection by Transport Canada on a prototype installation associated with an STC, L/STC, RDC, AP-TC or TSO design approval project will be determined by the regional engineer responsible for the project, and the applicant will be advised accordingly. Where such a requirement has been identified, the prototype installation is to be verified by the applicant or his designated person for conformity with the applicable installation drawings and, where required, ground tests performed to determine functionality. The above functions are to be carried out prior to the applicant requesting the required conformity inspection by TC representatives.

Confirmation

A written confirmation is to be provided to the responsible regional project engineer using the Conformity Inspection Record form appended to this notice, or an equivalent form acceptable to TC. The completed form is to be signed by an appropriately rated Aircraft Maintenance Engineer (AME) or Approved Maintenance Organization (AMO). TC form 24-0045 (Conformity Certificate - Repair or Modification), which is intended to certify the installation of an approved modification or repair, should not be used as a Conformity Inspection Record. The Conformity Inspection Record should be accompanied by details pertaining to the location of the test article, the proposed modification or repair, and a proposed date for accomplishing the conformity inspection by TC Airworthiness Inspectors.

For Minister of Transport

K.J. Mansfield
Director, Aircraft Certification

To request a change of address, contact the Civil Aviation Communications Centre (AARA) at Place de Ville, Ottawa, Ontario K1A 0N8, or 1-800-305-2059, or http://www.tc.gc.ca/aviation/pubs/index.htm.

Pour recevoir ces avis en français, prière de contacter le Centre de communications mentionné ci-haut.

TP 11402E 24-0081E (12-98)

Canada

5.1 Climb

L 22 26 R 22 27
18.5 M.P.

16 KTS.

5. 22 26 1/2 R 22 1/2 26
23 MP L 22 1/2 26 1/4

LEVEL

90 S 23 1/4 25.
L 23 25 1/4
R 23 1/2 25

60 S 23 27
M.P. 16.1 L 22 1/2 26 3/4
R 22 3/4 26 3/4

70 S 26 ⇄ 22 1/2
MP 16.0 L 22 1/4 26
R 22 1/4 26

80 S 22 3/4 25 1/2
L 22 3/4 26 1/4
M.P. 17.8 R 23 26
100% E/R.

LOW SPEED ⟷ ↕

HOV	21½	29½
R 20	22	29¼
L 20 mph.	20½	29
Back	21¼	30

Level ⇄

24	S	26	22½	95
~~23.5~~	L	22½	25¼	~~92~~ KMH 5
100%	R.	23¼	26	

→

Climb comp 80 00
14 - 24/00 25. ST
15. FIN

260° 1250 30 ST.
15

ADTR.

1700 FMSG.

60 - 88 KIAC.

DEMO SPEED

RCP 29 MP

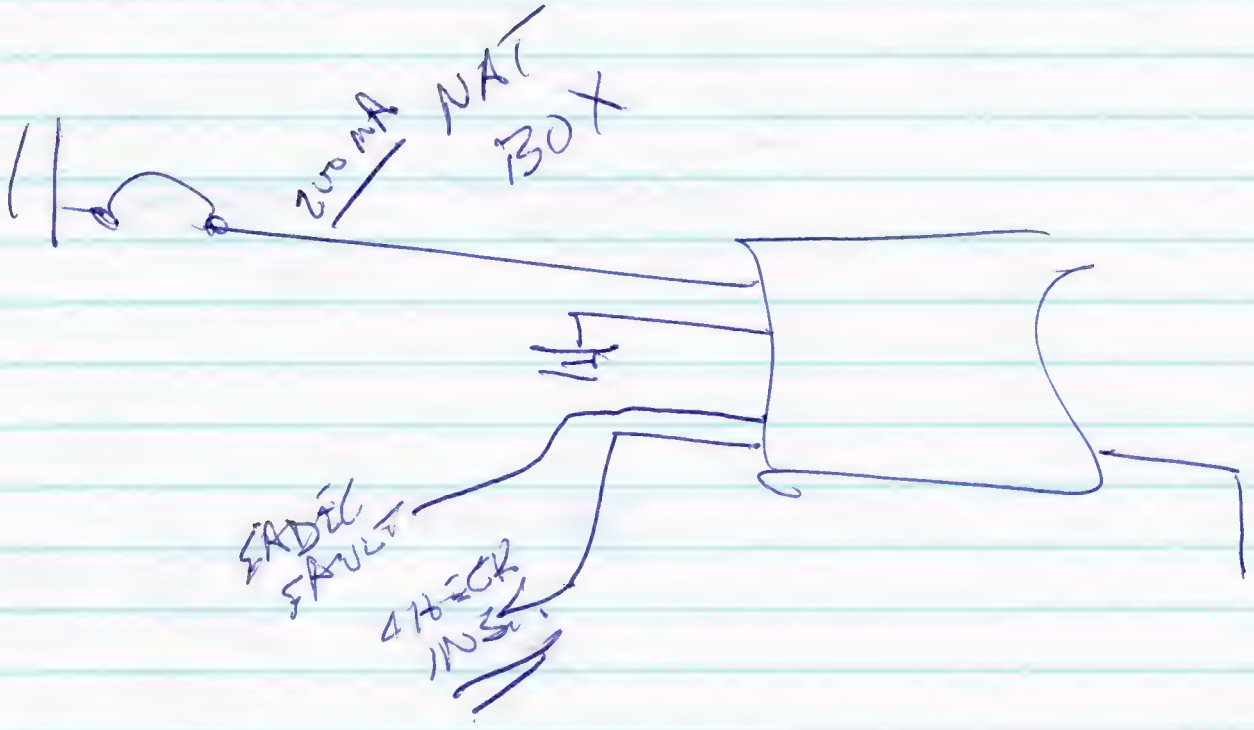
113 KIAC

1800 ASL.

5.6

landed wet field

2" of water


200 mA
NAC
BOX
EARTH
FAULT
47kΩ
1/4W

BASELINE

CLIMB

MCP 18

R.	23	26 ½
L	22	26 ½

MP 24

S	21 ¾	27
R	23 ¼	26 ½
L	23 ½	26 ½

ALT. 10000 ASL

LEVEL

MP 20.5

90	S	23	25
	L	23 ¼	25
		23 ¼	25

MP 24

95	S	23 ½	24 ½
	R	24	24
	L	23 ½	24 ½

180

~~A.C~~

80	S	23	26
	R.	23	26
		23	25 ¾

70

16.8	S	23	26 1/4
	R	23	26 1/2
	L	22 1/2	26 1/2

60

16.8	S	22	26 1/4
	L	23	26 3/4
	R	22 1/2	28 1/2

HOUSE	21¼	29 3/4
Back	21½	30¼
R	22	29½
L	20¾	29½

DEMO

CLIMB

		ALT	TIME
300	START	800	:50
	FINISH	1800	:37
		800	:03
120		1800	:53

AUTO

80 KIAS

85 195 1800 FPM

70

65

23 28

WEIGHT & BALANCE

BASIC EMPTY WEIGHT (CONFIG 2)		~~875.35~~ 883.25	~~103.5~~ 103.23	~~90619~~ 91177.41
MOD (BEAR PAWS		~~40~~.0	123.6	~~118~~ 741
PILOT		~~190~~ 190	78	14,820
CO-PILOT		210	78	16,380
		~~1369~~ 1288		
FUEL	Full Fuel			
AUX.	1/4	(~~108.6~~)(103.8) 26.0	63	1,638
MAIN	1/2	108.6 54.3	115	6,245
		~~1368.6~~ 1369.7	~~95.6~~ 95.64	~~130,878~~ 131,002

132 FOOD LIMIT

MAX GROSS WEIGHT 1370

61 #

C-GFZG
#44

EMPTY	1467.4	106.77	156674
MIRROR	.5	35	17.5
Fuel			
MAIN ½ x 184	92	106	9752
AUX ¼ x 110	27.5	102	2805
Pilot	190	49.5	9405
co-Pilot	200	49.5	9900
	1977.4	95.35	188,554

Adding fuel
fuel.

May G.W. 2400

FMS
$89.91
Richard Corp.
Andy Steadman

¼ AUX
½ MAIN,

Climb

MP 20.5	55	S.	24	26 1/2
		R.	24	26 1/4
		L.	24	27
	65	S.	23 1/2	26 1/2
		R.	24	26 1/4
		L	23 3/4	26 1/4

Level

14.5	~~60~~ 55	S	24	28
		R	24	27 1/4
		L	24	27 3/4
MP 18.0	70	S	24 1/4	26 3/4
		R.	24 1/2	26 3/4
		L	24	27
18.7	80	S	24 1/2	26 1/2
		R	24 1/2	27
		L	24 1/2	27
20.0	90	S	24 1/2	26
		R	24 3/4	26
		L	24 1/2	26 1/4

AUTO

100		
90	26¼	29
85.		

Vibrate - NO.

SLOW

HOVER	24	29½
RIGHT	25	30
L	23½	29½
BACK.	24	30

MP	100	S	~~25~~ 24 1/4	25
22		R	24 1/2	25 1/2
		L	24 1/2	25 1/2
MP	110	S.	24 1/2	25
24		R.	24 3/4	25
		L	24 1/4	25 1/2
26	115	S.	24 1/4	24
Not		R.	24 5/8	24
		L	24 1/2	24 1/2

Is slight

CLIMB.

HEAD 320

500 1.210

1500 1.T:49

500 20.07

1900 FM.

1950

HEAD 120

20:42

184 NO FLOTT

AERO Design Ltd.

FLIGHT TEST PLAN

FTP 649.02

Mirror Installation

Robinson R-22, R-44

Revision 1
30 January, 2006

AERO Design Ltd.
Engineering Consultants

2013 – 39th Avenue N.E., Calgary, Alberta T2E 6R7
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TABLE OF CONTENTS

1.0 INTRODUCTION

A mirror is installed on the front end of the skid tube to improve visibility of cargo slung under the helicopter.

2.0 REFERENCE

Rotorcraft Flight Manual, Robinson R22

Rotorcraft Flight Manual, Robinson R44

Aero Design Ltd. Installation Drawing 64901 and 64902, Mirror Installation.

3.0 BASIS OF CERTIFICATION

R22, R22 Alpha, R22 Beta, R22 Mariner

Type Certificate H10WE

FAR 27, including Amendment 27-10.

R44 and R44-II

Type Certificate H11NM granted December 10, 1992.

FAR 27, including Amendment 27-24.

This flight test programme will demonstrate that the installation of the Mirror complies with the flight requirements of the original basis of certification.

4.0 FLIGHT TEST PREPARATION

4.1 General

The flight crew should review and be familiar with the regulatory requirements of FAR 27 Subpart B - Flight prior to conducting flight tests. These requirements are included as Appendix C.

The flight crew should examine and be familiar with the modification installed including a review of the proposed Flight Manual Supplement (if any).

The relative cyclic stick position in the various flight conditions is to be determined by attaching light retracting type tape measures between the cyclic stick and the airframe in both the longitudinal and lateral directions.

Test points must be flown accurately allowing the aircraft to stabilize before data is recorded.

Each limiting condition should be approached with caution, using an incremental build-up approach.

The flight crew should always be attentive to unusual noises, vibrations, control characteristics, attitudes and instrument indications.

4.2 Configuration

Baseline flight

The helicopter shall be in the same configuration as flown for the modification flight test except that the external portions of the modification shall be removed. The helicopter shall be ballasted to obtain the same gross weight and centre of gravity as flown for the modification flight test.

Modification flight test

Those components of the modification which alter the external profile of the aircraft shall be installed in accordance with the applicable installation drawings.

Any other unusual or particularly large external modifications should be removed if practical and all external modifications installed during flight testing should be noted in the flight test report.

The aircraft is to be ballasted to its maximum gross weight.

4.3 Flight Authority

The Certificate of Airworthiness may not be valid after the modification has been installed. Flight Authority in the form of a flight permit may be required.

Flight authority to exceed the published V_{ne} of the helicopter is required. When the V_{ne} for the modification as provided in the proposed Flight Manual Supplement does not restrict the maximum speed to less that 90% of the basic helicopter V_{ne} then, the flight permit should specifically state that a higher V_{ne} is authorized.

4.4 Definitions

Stability: It shall be possible to fly the helicopter in normal maneuvers for a continuous period of time appropriate to the operational use of the particular type of helicopter without the pilot experiencing undue fatigue or strain.

Static longitudinal stability: The characteristics of the longitudinal cyclic control shall be such that, with constant throttle and collective pitch settings, a rearward displacement of the longitudinal control shall be necessary to obtain and maintain speeds below the specified trim speed, and a forward displacement shall be necessary to obtain and maintain speeds above the specified trim speed.

Adequate control margins: There is adequate control and stick movement available from the position at the trim speed to the control stops or other obstructions to stick movement to safely control the helicopter.

5.0 FLIGHT TEST PROCEDURE

5.1 Flight Characteristics

Controllability Stability Flutter and Vibration

FAR 27.141, 27.143, 27.171, 27.177 and 27.629

Low Speed

FAR 27.141(b), 27.143(a), 27.143(c), 27.171, 27.175(d) and 27.629

Hover in a fixed position at a skid height of approximately 5 – 15 ft above the ground

Translate in both sideward directions and in a rearward direction into the prevailing wind until airspeed estimated to be 17 knots (20 mph) has been reached.

Record:
- adequate control margins
- Relative lateral and longitudinal stick position (tape measurement)
- Observe and record any indications of flutter or vibrations

V_y = 55 KIAS

Climb

FAR 27.141(b), 27.143(a), 27.171, 27.175(a), 27.177 and 27.629

At the recommended climb speed, V_y, from the Basic Flight Manual increase power slowly until reaching Maximum Continuous Power

Make a 30° bank turn to the left and to the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Qualitative assessment of directional stability
- Observe and record any indications of flutter or vibrations

Level Flight

FAR 27.141(b), 27.143(a), 27.171, 27.175(b), 27.177, and 27.629

Transition from hover to forward flight increasing the speed incrementally in 10 mph steps until Maximum Continuous Power is being applied, or V_{ne} from the proposed Flight Manual Supplement is reached, whichever is less.

At each speed increment make a 30° bank turn to the left and the right

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Qualitative assessment of directional stability
- Observe and record any indications of flutter or vibrations

R44: In the basic Flight Manual, V_{ne} is 130 KIAS up to 2200 pounds, and 120 KIAS above.

R22: In the basic Flight Manual, V_{ne} is 98 KCAS.

At Maximum Continuous Power, V_h, or V_{ne} from the proposed Flight Manual Supplement, whichever is less

FAR 27.143(a)

Record:
- stable airspeed, V_h
- record if V_{ne} was reached prior to applying MCP

Continue to accelerate the aircraft in 10 mph increments by maintaining Maximum Continuous Power and descending as necessary V_{ne} is reached.

FAR 27.143(b) and 27.629

At each speed increment make a 30° bank turn to the left and to the right

At V_{ne} ensure there are adequate control margins and adequate pitch control

Record:
- adequate control margins
- Relative lateral and longitudinal stick position
- Positive static longitudinal stability
- Observe and record any indications of flutter or vibrations

For the flight test with modification installed only

Compare the longitudinal stick position (as measured with the measuring tape attached to the cyclic stick) for modification installed flight test to the position obtained in the baseline flight at V_{ne} this point. If the longitudinal stick position is further forward at V_{ne} with the modification installed (basic helicopter V_{ne} or proposed Flight Manual Supplement V_{ne}, whichever is less) than was determined during the baseline flight at V_{ne} then it may be necessary to further limit the V_{ne} with the modification installed due to mast bending considerations.

Applying power as required, and further descending the helicopter if necessary, cautiously accelerate the helicopter until the longitudinal cyclic stick position is in the same location as was determined in the baseline flight at V_{ne} from the basic helicopter Flight Manual.

Record:
- speed at which, for the modification installed, longitudinal cyclic stick position is in the same location as was determined in the baseline flight at the V_{ne}.

Autorotation

FAR 27.141(b), 27.143(a)(v), 27.143(d), 27.175(c) and 27.629

At each of V_y, normal cruise speed and V_h, from level flight (if possible) simulate a sudden engine failure by rapidly retarding the throttle to the idle position. The collective stick must be kept in the power-on position for at least one (1) second after the throttle is retarded before any response is made.

70 KIAS

Record:
- assess that autorotation entry characteristics not changed from basic aircraft
- observe and report any unusually rapid rotor speed decay.
- For entry speed at V_h, adequate pitch and roll control

During descent, vary forward speed between 50% $V_{min\ rate\ of\ descent}$ and $V_{ne\ autorotation}$, making gentle turns to the left and to the right.

Record:
- adequate control margins
- unusual pitch, roll or yaw rates
- observe and record any indications of flutter or vibrations

5.2 Performance

FAR 27.65(b)

If the external modification is of significant size and shape as to affect the climb performance of the helicopter the following procedure shall be included in the flight test.

On a compass heading at 90° to the local wind conditions, from level flight at the recommended climb speed, V_y, increase power to Maximum Continuous Power maintaining airspeed. When a steady rate of climb is established, note the altimeter reading and measure the time to climb through an altitude of 1000 ft.

Record:
- Starting altitude
- Time to climb through 1000 ft.

Repeat the above procedure on the reciprocal compass heading starting at the same altitude

Record:
- Starting altitude
- Time to climb through 1000 ft.

5.3 Flight at Demonstration Speed

FAR 27.629, 27.309 and 27.1505(a)

Caution: The rotorcraft should be maneuvered gently above V_{ne}

The aircraft should be accelerated slowly above V_{ne} to ensure the target airspeed is not passed.

Applying Maximum Continuous Power and descending the aircraft as required, cautiously accelerate the aircraft to 1.11 times V_{ne}

Make a 30° bank turn to the left and the right

Record:
- maximum airspeed attained
- observe and record any indications of flutter or vibrations

R44: In the basic Flight Manual, V_{ne} is 130 KIAS below 2200 pounds, therefore V_d must not exceed 144 KIAS.

At weights above 2200 pounds, V_{ne} is 120 KIAS, hence V_d may not exceed 133 KIAS.

R22: In the basic Flight Manual, V_{ne} is 98 KCAS, therefore V_d must not exceed 109 KCAS

5.4 Take off and Landing

FAR 27.51(a)(1), 27.75(a)(1) and 27.231

With the modification installed, perform a landing on soft ground. Observe for tendency of the installation to stick or catch in the soft ground, or any other condition that may create a hazard.

Take off from soft ground. Observe for tendency of the installation to stick or catch in the soft ground, or any other condition that may create a hazard.

5.5 Other Observations

Effect of modification on normal and emergency procedures

Record: - Comment

Effect of modification on normal and emergency egress

Record: - Comment

Evaluation of modification Flight Manual Supplement

Record: - Comment

APPENDIX A

FLIGHT TEST REPORT

APPENDIX B

WEIGHT AND BALANCE CALCULATIONS

APPENDIX C

FAR 27 REQUIREMENTS

Sec. 27.65 – Climb: All engines operating.

(a) For rotorcraft other than helicopters--
(1) The steady rate of climb, at V_Y, must be determined--
(i) With maximum continuous power on each engine;
(ii) With the landing gear retracted; and
(iii) For the weights, altitudes, and temperatures for which certification is requested; and
(2) **[**The climb gradient, at the rate of climb determined in accordance with paragraph (a)(1) of this section, must be either--**]**
(i) At least 1:10 if the horizontal distance required to take off and climb over a 50-foot obstacle is determined for each weight, altitude, and temperature within the range for which certification is requested; or
(ii) **[**At least 1:6 under standard sea level conditions.**]**
(b) Each helicopter must meet the following requirements:
(1) V_Y must be determined--
(i) For standard sea level conditions;
(ii) At maximum weight; and
(iii) With maximum continuous power on each engine.
(2) **[**The steady rate of climb must be determined--
(i) At the climb speed selected by the applicant at or below V_{NE};
(ii) Within the range from sea level up to the maximum altitude for which certification is requested;
(iii) For the weights and temperatures that correspond to the altitude range set forth in paragraph (b)(2)(ii) of this section and for which certification is requested; and
(iv) With maximum continuous power on each engine.**]**

Sec. 27.141 – Flight Characteristics: General.

The rotorcraft must--
[(a) Except as specifically required in the applicable section meet the flight characteristics requirements of this subpart--
(1) At the altitudes and temperatures expected in operation;**]**
(2) Under any critical loading condition within the range of weights and centers of gravity for which certification is requested;
(3) For power-on operations, under any condition of speed, power, and rotor r.p.m. for which certification is requested; and
(4) For power-off operations, under any condition of speed and rotor r.p.m. for which certification is requested that is attainable with the controls rigged in accordance with the approved rigging instructions and tolerances;
(b) Be able to maintain any required flight condition and make a smooth transition from any flight condition to any other flight condition without exceptional piloting skill, alertness, or strength, and without danger of exceeding the limit load factor under any operating condition probable for the type, including--
(1) Sudden failure of one engine, for multiengine rotorcraft meeting Transport Category A engine isolation requirements of Part 29 of this chapter; and
(2) Sudden, complete power failure, for other rotorcraft; and
(3) Sudden, complete control system failures specified in Sec. 27.695 of this Part; and
(c) Have any additional characteristic required for night or instrument operation, if certification for those kinds of operation is requested. Requirements for helicopter instrument flight are contained in Appendix B of this Part.

Sec. 27.143 – Controllability and maneuverability.

(a) The rotorcraft must be safely controllable and maneuverable--
(1) During steady flight; and
(2) During any maneuver appropriate to the type, including--
(i) Takeoff;
(ii) Climb;
(iii) Level flight;
(iv) Turning flight;
(v) Glide;
(vi) Landing (power on and power off); and
(vii) Recovery to power-on flight from a balked autorotative approach.
(b) The margin of cyclic control must allow satisfactory roll and pitch control at V_{NE} with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Power off (except for helicopters demonstrating compliance with paragraph (e) of this section) and power on.
(c) A wind velocity of not less than 17 knots must be established in which the rotorcraft can be operated without loss of control on or near the ground in any maneuver appropriate to the type (such as crosswind takeoffs, sideward flight, and rearward flight), with--
(1) Critical weight;
[(2) Critical center of gravity;
(3) Critical rotor r.p.m.; and
(4) Altitude, from standard sea level conditions to the maximum altitude capability of the rotorcraft or 7,000 feet, whichever is less.]
(d) The rotorcraft, after (1) failure of one engine in the case of multiengine rotorcraft that meet Transport Category A engine isolation requirements, or (2) complete engine failure in the case of other rotorcraft, must be controllable over the range of speeds and altitudes for which certification is requested when such power failure occurs with maximum continuous power and critical weight. No corrective action time delay for any condition following power failure may be less than--
(i) For the cruise condition, one second, or normal pilot reaction time (whichever is greater); and
(ii) For any other condition, normal pilot reaction time.
(e) For helicopters for which a V_{NE} (power-off) is established under Sec. 27.1505(c), compliance must be demonstrated with the following requirements with critical weight, critical center of gravity, and critical rotor r.p.m.:
(1) The helicopter must be safely slowed to V_{NE} (power-off), without exceptional pilot skill, after the last operating engine is made inoperative at power-on V_{NE}.
(2) At a speed of 1.1 V_{NE} (power-off), the margin of cyclic control must allow satisfactory roll and pitch control with power off.

Sec. 27.171 – Stability: General

The rotorcraft must be able to be flown, without undue pilot fatigue or strain, in any normal maneuver for a period of time as long as that expected in normal operation. At least three landings and takeoffs must be made during this demonstration.

Sec. 27.173 – Static longitudinal stability.

[(a) The longitudinal control must be designed so that a rearward movement of the control is necessary to obtain a speed less than the trim speed, and a forward movement of the control is necessary to obtain a speed more than the trim speed.
(b) With the throttle and collective pitch held constant during the maneuvers specified in Sec. 27.175(a) through (c), the slope of the control position versus speed curve must be positive throughout the full range of altitude for which certification is requested.
(c) During the maneuver specified in Sec. 27.175(d), the longitudinal control position versus speed curve may have a negative slope within the specified speed range if the negative motion is not greater than 10 percent of total control travel.]

Sec. 27.175 – Demonstration of static longitudinal stability.

(a) *Climb.* Static longitudinal stability must be shown in the climb condition at speeds from 0.85 V_Y to 1.2 V_Y, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Maximum continuous power;
(4) The landing gear retracted; and
(5) The rotorcraft trimmed at V_Y.
(b) *Cruise.* Static longitudinal stability must be shown in the cruise condition at speeds from 0.7 V_H or 0.7 V_{NE}, whichever is less, to 1.1 V_H or 1.1 V_{NE}, whichever is less, with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power for level flight at 0.9 V_H or 0.9 V_{NE}, whichever is less;
(4) The landing gear retracted; and
(5) [The rotorcraft trimmed at 0.9 V_H or 0.9 V_{NE}, whichever is less.]
(c) *Autorotation.* Static longitudinal stability must be shown in autorotation at airspeeds from 0.5 times the speed for minimum rate of descent to V_{NE} or to 1.1 V_{NE} (power-off) if V_{NE} (power-off) is established under Sec. 27.1505(c), and with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power off;
(4) The landing gear--
(i) Retracted; and
(ii) Extended; and
(5) The rotorcraft trimmed at appropriate speeds found necessary by the Administrator to demonstrate stability throughout the prescribed speed range.
(d) *Hovering.* For helicopters, the longitudinal cyclic control must operate with the sense and direction of motion prescribed in Sec. 27.173 between the maximum approved rearward speed and a forward speed of 17 knots with--
(1) Critical weight;
(2) Critical center of gravity;
(3) Power required to maintain an approximate constant height in ground effect;
(4) The landing gear extended; and
(5) The helicopter trimmed for hovering.

Sec. 27.177 – Static directional stability.

[Static directional stability must be positive with throttle and collective controls held constant at the trim conditions specified in Sec. 27.175 (a) and (b). This must be shown by steadily increasing directional control deflection for sideslip angles up to $\pm 10°$ from trim. Sufficient cues must accompany sideslip to alert the pilot when approaching sideslip limits.]

AERO Design Ltd.

ENGINEERING REPORT
ER649.01

MIRROR INSTALLATION

Robinson R22 / R44

Approved: E. Burgoin, P. Eng.

Prepared by: Jeff Clarke

Revision 0
Date: 26 January, 2006

AERO Design Ltd.
Engineering Consultants

2013 – 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333
E-Mail: aerodesign@telusplanet.net

TABLE OF CONTENTS

1.0 INTRODUCTION

A mirror is required for the pilot to watch loads that are slung from the cargo hook. This installation will install a commercially available 5" to 6" diameter mirror. The mirror is attached to the forward end of the right skid tube.

2.0 REFERENCE

Aero Design Ltd. Drawings 64901 and 64902

Streeter, Fundamentals of Fluid Mechanics

MIL-HDBK-5J

3.0 BASIS OF CERTIFICATION

Robinson R44, R44 II, TCDS H-97

FAR 27, dated February 1, 1965, including amendments 27-1 thru 27-24.

Robinson R22, R22 Alpha, R22 Beta, R22 Mariner, TCDS H10WE

FAR 27, dated February 1, 1965, including amendments 27-1 thru 27-10.

This installation:

Same as the basis of certification for the R44 shown above.

4.0 ANALYSIS OF CURRENT AIRWORTHINESS DIRECTIVES (AD'S)

There are no current AD's related to this installation.

5.0 STRUCTURAL COMPLIANCE

The mirror weighs about 0.5 lb. It is secured with an AN5 bolt. Inertial loads generated by this installation are not significant.

Drag load on the mirror must be considered.

$V_{ne} := 130 \cdot knots$ Never exceed speed (R44) (Ref: TCDS)

$V_d := \frac{V_{ne}}{0.9}$

$V_d = 144.4 \cdot knots$ Design dive speed

$A := \pi \cdot (3 \cdot in)^2$

$A = 28.3 \cdot in^2$ Area of mirror (6" diameter)

Using Fundamentals of Fluid Mechanics by Streeter, the coefficient of drag can be determined. Figure 5.21 (see appendix A) gives drag coefficients for circular disks. The values range from a maximum of 1.8 at Reynolds number of 250 to 1.2 for Reynolds number of 2000 and greater. To be conservative, C_d of 1.8 is used.

$C_d := 1.8$ Coefficient of drag (Ref: Streeter Fig 5.21)

$\rho := 0.002378 \cdot \frac{slug}{ft^3}$ Air density (Sea Level)

$D := C_d \cdot \frac{1}{2} \cdot \rho \cdot V_d^2 \cdot A$

$D = 24.9 \cdot lbf$ Drag load at design dive speed

$D_{ult} := D \cdot n_{sf}$

$D_{ult} = 37.4 \cdot lbf$ Ultimate drag load

Where:

$n_{sf} = 1.5$ Safety Factor (Ref: FAR 27.303)

The ultimate strength of an AN5 bolt is as follows:

P_{su} = 5750 lb Ultimate shear strength (Ref: MIL-HDBK-5J)

P_{tu} = 6710 lb Ultimate tensile strength (Ref: MIL-HDBK-5J)

The bolt is sufficient to carry the combined drag and inertial loads.

APPENDIX A

EXCERPT FROM FUNDAMENTALS OF FLUID MECHANICS

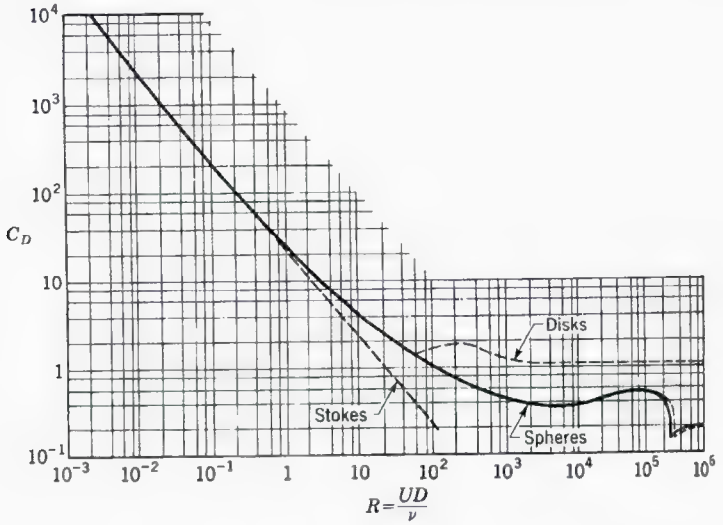

Fig. 5.21 *Drag coefficients for spheres and circular disks.*

very large wake with a resulting large pressure drag. In *b*, the nose of the sphere, roughened by sand glued to it, induced an early transition to turbulent boundary layer before separation occurred. The high momentum transfer in the turbulent boundary layer delayed the separation so that the wake is substantially reduced, resulting in a total drag on the sphere less than half that occurring in *a*.

A plot of drag coefficient against Reynolds number (Fig. 5.21) for smooth spheres shows that the shift to turbulent boundary layer (before separation) occurs by itself at a sufficiently high Reynolds number, as evidenced by the sudden drop in drag coefficient. The exact Reynolds number for the sudden shift depends upon the smoothness of the sphere and upon the turbulence in the fluid stream. In fact, the sphere is frequently used as a turbulence meter by determining the Reynolds number at which the drag coefficient is 0.30, a point located in the center of the sudden drop (Fig. 5.21). By use of the hot-wire anemometer, Dryden[1] has correlated the turbulence level of the fluid stream to the Reynolds number for the sphere at $C_D = 0.30$. The greater the turbulence of the fluid stream, the smaller the Reynolds number for shift in separation point.

In Sec. 7.8, for ideal-fluid flow, equations are developed that permit the velocity and pressure to be found at any point in the fluid for flow around a

[1] H. Dryden, Reduction of Turbulence in Wind Tunnels, *NACA Tech. Rept.* 392, 1931.

INSTRUCTIONS FOR CONTINUED AIRWORTHINESS
ICA 649.90

MIRROR INSTALLATION

Robinson R22, R22 Alpha/Beta/Mariner
Robinson R44, R44 II

Preface

These Instructions for Continued Airworthiness shall be included in the Robinson R22 (series) or R44 (series) Maintenance Manual when the Mirror is installed in accordance with AERO Design Ltd. Document Control List DCL649, Revision 0, or later approved revision.

The information contained herein supplements the information in the basic Maintenance Manual. For Maintenance practices and procedures not contained in these Instructions for Continued Airworthiness refer to the basic Maintenance Manual and its approved supplements.

Revision 0
Date: 26 January, 2006

AERO Design Ltd.

2013 39th Avenue N.E., Calgary, Alberta T2E 6R7
Phone: (403) 250-8027
Fax: (403) 250-8333

RECORD OF REVISIONS

Revision Number	Issue Date	Date Inserted	By
0			Original Issue

LIST OF EFFECTIVE PAGES

Chapter – Section - Subject	Page	Revision No.
5-TITLE	1	0
5-EFFECTIVITY	2	0
5-00-00	3	0
5-10-00	4-8	0

TABLE OF CONTENTS

SECTION 5 – LANDING GEAR

5-1 INTRODUCTION

The following Instructions for Continued Airworthiness (ICA) satisfy the requirements of 14 CFR 27.1529, and provide the information necessary to complete the on-going maintenance and inspections required for the Robinson R22 series and R44 series rotorcraft when modified with the Mirror Installation as described herein. The installation is the same for all models of R22 and R44 rotorcraft except as noted.

5-2 REFERENCE DOCUMENTS

AERO Design Ltd. Installation drawing 64901 (R44) and 64902 (R22)

5-3 DEFINITIONS AND ABBREVIATIONS

BL - Butt Line (RBL is Right Butt Line, LBL is Left Butt Line)
FS - Flight Station
ICA - Instructions for Continued Airworthiness
P/N - Part Number

5-4 GENERAL DESCRIPTION

The Mirror Installation consists of a commercially available convex mirror that is attached to the forward end of the right skid tube. The mirror is to allow the pilot to monitor loads slung from the cargo hook.

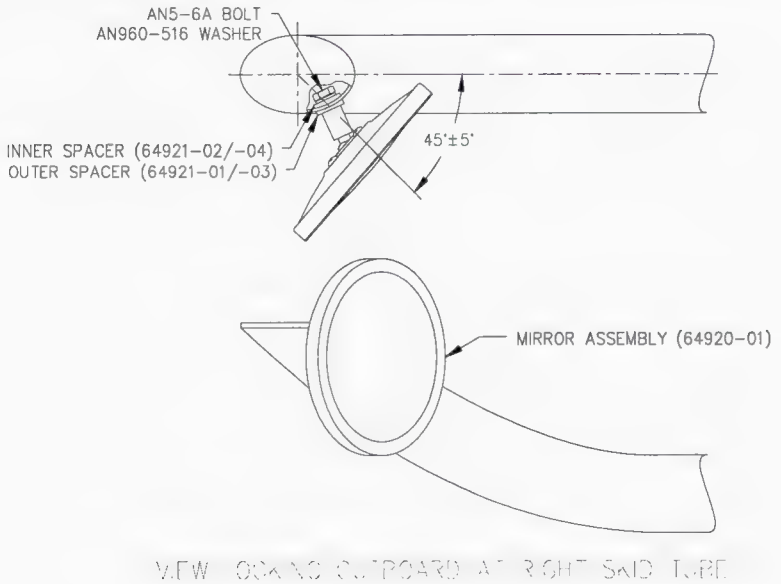

Figure 1 – Mirror Installation

5-5 CONTROL AND OPERATING INFORMATION

Not applicable.

5-6 SERVICING INFORMATION

The Mirror Installation does not affect the original rotorcraft servicing information. All components used with the Mirror Installation are "On Condition" items. Periodic servicing is not required.

1. Mirror Adjustments

a) If the mirror will not hold the desired position, tighten the screws on the back of the mirror to adjust clamp-up on the ball joint.

b) If the mirror cannot be moved to the desired position, loosen the screws on the back of the mirror to adjust clamp-up on the ball joint.

5-7 MAINTENANCE INSTRUCTIONS

1. Inspection Schedule and Instructions

Continued airworthiness is contingent upon compliance with the following inspection items. These items shall be completed in conjunction with the Robinson R22 or R44 Maintenance Inspection schedule, or other approved program, or upon removal and replacement of any component of the Mirror Installation.

Daily Inspection

1. Inspection Area: Skid Tube

a) Inspect the mirror for any signs of damage, cracks or corrosion.
b) Inspect skid tube at mirror attachment for any signs of damage, cracks or corrosion.
c) Inspect the mirror attachment for condition and security.

100 hour or Annual Inspection

1. Inspection Area: Skid Tube

a) Remove mirror assembly.
b) Inspect mirror for any signs of damage, cracks, or corrosion.
c) Inspect fastener holes in skid tube for elongation, wear, or other damage.
d) Re-install mirror.

2. Repair Instructions

1. Mirror Lug

The mounting lug may be cadmium plated steel (depending on the manufacturer). If cadmium plating is scratched and the lug begins to corrode, the corrosion must be removed or the mirror assembly must be replaced.

a) Remove all traces of corrosion by abrasive or chemical means. Protect mirror surface and housing from abrasives or chemicals.

Caution: Follow manufacturers instructions and safety precautions when using chemicals.

b) Prime and paint lug.

2. Mirror

If mirror is damaged, cracked or corroded, discard and replace with new mirror.

Acceptable mirrors:

Signal-Stat 7315 (5" Diameter)
Signal-Stat 7318 (6" Diameter)

If the above mirrors cannot be located, an alternate may be obtained from any commercial auto-parts supply store. The mirror must meet the requirements shown in Figure 2.

Figure 2 – Mirror Requirements

5-8 TROUBLE SHOOTING INFORMATION

Not applicable.

5-9 REMOVAL AND REPLACEMENT INFORMATION

1. Mirror Removal

Refer to figure 1.

1. Remove end cap from forward tip of right skid tube. Cap is secured with sealant. Remove all traces of sealant from cap and skid tube.
2. Unthread mirror from AN5 bolt.
3. Remove one (1) AN5-6A bolt, one (1) AN960-516 washer, one (1) 64921-01 (R44) or 64921-03 (R22) outer spacer and one (1) 64921-02 (R44) or 64921-04 (R22) inner spacer.

4. Re-install cap on forward end of skid tube using PR1422B2 sealant or equivalent.

Note: If mirror installation is to be permanently removed, do not perform step 3. Install MS21044N5 nut on AN5 bolt. Torque to 100-140 in-lbs. Continue with step 4.

2. Mirror Installation

Refer to figure 1.

1. Remove end cap from forward tip of right skid tube. Cap is secured with sealant. Remove all traces of sealant from cap and skid tube.
2. Insert (1) AN5-6A bolt with one (1) AN960-516 washer and one (1) 64921-02 (R44) or 64921-04 (R22) inner spacer in hole in forward end of skid tube.
3. Place one (1) 64921-01 (R44) or 64921-03 (R22) outer spacer on AN5 bolt. Ensure inner and outer spacers are correctly aligned with skid tube.
4. Apply Loctite 262 or equivalent to AN5 bolt. Thread mirror assembly 64920-01 onto AN5 bolt. Torque bolt to 100-140 in-lbs.
5. Re-install cap on forward end of skid tube using PR1422B2 sealant or equivalent.

5-10 MARKINGS AND PLACARDS

Not applicable.

5-11 DIAGRAMS OF ACCESS PANELS

Not applicable.

5-12 SPECIAL INSPECTION TECHNIQUES AND INSTRUCTIONS

1. Hard Landing

Following a hard landing inspect the Mirror Installation in accordance with the daily inspection listed above in Section 5-7.

5-13 PROTECTIVE TREATMENT INFORMATION

The mirror housing is fabricated from stainless steel and does not require any additional protective treatment.

The mounting lug may be cadmium plated steel (depending on the manufacturer). If cadmium plating is compromised, any corrosion must be removed (see section 5-7) and the lug must be primed and painted.

5-14 STRUCTURAL FASTENER DATA

Refer to basic helicopter maintenance manual.

5-15 LIST OF SPECIAL TOOLS

Not applicable.

5-16 AIRWORTHINESS LIMITATIONS

The Airworthiness Limitations section is Transport Canada approved and specifies maintenance required under Section 571 of the Canadian Aviation Regulations, unless an alternative program has been approved.

No additional limitations have been imposed due installation of the Mirror Installation.

5-17 DISTRIBUTION AND AMENDMENTS

Copies of this ICA and amendments shall be distributed to all known purchasers of the Mirror Installation.

AERO DESIGN LTD.
2013 – 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027
Fax: 403-250-8333
aerodesign@telusplanet.net

FAXED
23 JAN 2006

23 January, 2006

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : C-05-0255, C-06-0052
Our File : 640, 649

Re: Robinson R22/R44 Bear Paws and Cargo Mirror

Greg,

Please find attached the following documents related to this project:

Bear Paws: Modification Approval Request Application Form	MOD640	Revision 1
Cargo Mirror Compliance Program	CP649	Revision 1

Please extend my delegation to include the following paragraphs of FAR 27 as listed on compliance program CP649, revision 1:

27.45 Performance – General
27.51 Takeoff
27.65 Climb: All Engines Operating
27.67 Climb: One Engine Inoperative
27.73 Performance at Minimum Operating Speed
27.75 Landing
27.79 Limiting Height-Speed Envelope
27.141 Flight Characteristics – General
27.143 Controllability and Maneuverability
27.161 Trim Control
27.171 Stability: General
27.173 Static Longitudinal Stability
27.175 Demonstration of Static Longitudinal Stability
27.251 Vibration
27.629 Flutter

Regards,

E. Burgoin, P.Eng, DAR 290M

Encl.

APPLICANT: AERO Design Ltd.
2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

CORRESPONDANCE TO: AERO Design Ltd.
(If other than applicant) 2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

DATE: January 16, 2006
REV. No. 1 23 January, 2006

MAKE: Robinson
MODEL: R22, R44

REGISTRATION: All eligible
SERIAL No.: All eligible

NATURE OF WORK: Mirror Installation

MODEL CERTIFICATION BASIS: FAR 27, February 1, 1965, including amentments 27-1 through 27-24
MODIFICATION CERTIFICATION BASIS: FAR 27, February 1, 1965, including amentments 27-1 through 27-24

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B	**Flight**				
27.29	Empty Weight and Corresponding C of G	Weight and Balance data on inst. dwg		X	
27.45	Performance – General	Flight Test		X	
27.51	Takeoff	Flight Test		X	
27.65	Climb: All Engines Operating	Flight Test		X	
27.67	Climb: One Engine Inoperative	Flight Test		X	
27.73	Performance at Minimum Operating Speed	Flight Test		X	
27.75	Landing	Flight Test		X	Flight test to determine that installation does
27.79	Limiting Height-Speed Envelope	Flight Test		X	not cause excessive vibration of the landing
27.141	Flight Characteristics – General	Flight Test		X	gear in accordance with Flight Test Plan
27.143	Controllability and Maneuverability	Flight Test		X	FTP649.02, to be witnessed by DAR 290M
27.161	Trim Control	Flight Test		X	
27.171	Stability: General	Flight Test		X	
27.173	Static Longitudinal Stability	Flight Test		X	
27.175	Demonstration of Static Longitudinal Stability	Flight Test		X	
27.251	Vibration	Flight test		X	
Subpart C	**Strength Requirements**				
27.301	Loads	Statement in report		X	
27.303	Factor of Safety	Statement in report		X	Mirror weighs about 0.5 lb. Loads are not
27.305	Strength and Deformation	Statement in report		X	significant
27.307	Proof of Structure	Statement in report		X	

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
27.337	Limit Maneuvering Load Factor	Statement in report		X	| Mirror weighs about 0.5 lb. Loads are not
27.561	Emergency Landing Conditions – General	Statement in report		X	| significant
Subpart D	**Design and Construction**				
27.601	General	Use of conventional design		X	
27.603	Materials	Specification on drawings		X	
27.605	Fabrication Methods	Specification on drawings		X	
27.607	Fasteners	Specification on drawings		X	
27.609	Protection of Structure	Specification on drawings		X	
27.611	Inspection Provisions	Design		X	
27.613	Mat'l Strength Properties and Design Values	Use of MIL-HDBK-5		X	
27.629	Flutter	Flight Test		X	Flight test to determine that installation does not cause excessive flutter of the landing gear
Subpart G	**Operating Limitations and Information**				
27.1529	Instructions for Continued Airworthiness	ICA provided	X		

MODIFICATION APPROVAL REQUEST APPLICATION FORM

MOD649, Rev. 0

1. NAME AND ADDRESS OF APPLICANT:	2. IDENTIFICATION OF PRODUCT	
AERO Design Ltd. 2013 39th Ave NE Calgary, AB, T2E 6R7	MAKE: Robinson	MODEL: R22, R44
ALL CORRESPONDANCE TO: AERO Design Ltd. 2013 39th Ave N.E. Calgary, AB T2E 6R7	SERIAL No.: All eligible	REGISTRATION: All eligible

3. REQUEST FOR:

A. SUPPLEMENTAL TYPE CERTIFICATE (STC)	☒	
B. STC/STA REVISION	☐	STC/STA No.
C. LIMITED SUPPLEMENTAL TYPE CERTIFICATE (LSTC)	☐	
D. LIMITED STC/STA REVISION	☐	LSTC/LSTA No.
E. F.A.A. SUPPLEMENTAL TYPE CERTIFICATE	☐	
F. F.A.A. STC REVISION	☐	STC No.
G. FAMILIARIZATION OF F.A.A. STC	☐	STC No.
H. REPAIR DESIGN APPROVAL (RDC)	☐	
I. PARTS DESIGN APPROVAL (PDA)	☐	

4. TITLE OF MODIFICATION OR REPAIR:
Mirror Installation

5. BRIEF DESCRIPTION OF MODIFICATION OR REPAIR:
A mirror is required for the pilot to watch loads that are slung from the cargo hook. This installation will install a commercially available mirror. The mirror is attached to the forward end of the right skid tube.

6. APPLICABLE TYPE APPROVAL (TA) OR TYPE CERTIFICATE (TC) DOCUMENTS:
A. TA NO. H-97 (R44) B. TC No. H10WE (R22) C. OTHER _____

7. PROPOSED BASIS OF APPROVAL:
A. SAME AS TA ☒ B. SAME AS TC ☐ C. OTHER ☐ (Please specify) _____

8. DOCUMENTATION CHECKLIST	REQUIRED		FOR DOT USE ONLY RECEIVED		
	YES	NO	YES	NO	DATE
COMPLIANCE PROGRAM	X				
MASTER DRAWING LIST	X				
FLIGHT MANUAL SUPPLEMENT		X			
MAINTENANCE MANUAL SUPPLEMENT		X			
INSTRUCTIONS FOR CONTINUING AIRWORTHINESS	X				
ENGINEERING REPORTS	X				
DESIGN DRAWINGS		X			
MANUFACTURE DRAWINGS & INSTALLATION INSTRUCTIONS	X				
ELECTRICAL LOAD ANALYSIS		X			
DRAFT STC, LSTC OR RDA		X			
WEIGHT AND MOMENT CHANGE	X				
FLIGHT TEST DATA		X			
OTHER (Specify)					

9. APPLICANT'S REMARKS:

10. In addition to the payment of Aircraft Certification approval fees as prescribed in Canadian Aviation Regulations (CAR) Section 104, I agree to reimburse Transport Canada incremental expenses as in Aviation Regulation Directive No. 3, or equivalent, as applicable. For further details governing cost recovery, refer to AMA 612/4.

PER: _____ Consultant 16 January, 2006
SIGNATURE OF APPLICANTS TITLE DATE

11. _____ 2005-01-16
SIGNATURE OF REGIONAL ENGINEER DATE

Form MOD, 25 March, 2001

C-06-0052

FAXED

Jeff Clarke

From: Oucharek, Gregory [OUCHARG@tc.gc.ca]
Sent: Tuesday, January 17, 2006 10:49 AM
To: jeff@aerodesign.ca
Subject: RE: Robinson R22 Bear Paws

Jeff,

I am somewhat confused on the content of FTP649 vs CP649. It appears that the scope of testing is considerably greater that what is proposed for compliance as most of the Flight paragraphs are indicated N/A? Also, paragraphs indicated for TC ... if this is the case, Serge or I will participate in the Flight Test (unfortunately, my involvement will require cost recovery). Can you please clarify these items.

Thanks,

Greg

-----Original Message-----
From: Jeff Clarke [mailto:jeff@aerodesign.ca]
Sent: Monday, January 16, 2006 10:46 AM
To: Oucharek, Gregory
Subject: Robinson R22 Bear Paws

Greg,

As discussed this morning, we would like to add the Robinson R22 to our R44 Bear Paws Approval (STC SH05-17).

We have fabricated a set of R22 bear paws for E&B Helicopters. A flight test is needed to add this configuration to the STC. Attached is a proposed flight test plan, essentially the same as used for the R44. If the test plan is acceptable, we can proceed with arranging a test flight.

Along with the bear paws, a mirror installed on the forward end of the skid tube is desired for observing cargo on both the R22 and R44. This is an ideal time to get all testing finished for both projects in one trip. Attached is a proposed flight test plan for the mirror installation, as well as some pictures of a similar installation. The mirror is a 5" or 6" diameter convex mirror. This installation will use curved washers to match the curvature of the skid tube for mounting the mirror (not done on other available installations), and the mirror is secured with an AN5 bolt. Per your request, an application for this project is on the fax now.

Please let me know if you have any questions or concerns.

Jeff Clarke
Technologist

Jeff Clarke

From: Oucharek, Gregory [OUCHARG@tc.gc.ca]
Sent: Monday, January 16, 2006 11:57 AM
To: jeff@aerodesign.ca
Subject: RE: Robinson R22 Bear Paws

Thanks Jeff.

Do you also have an application for the STC revision?

Greg

-----Original Message-----
From: Jeff Clarke [mailto:jeff@aerodesign.ca]
Sent: Monday, January 16, 2006 10:46 AM
To: Oucharek, Gregory
Subject: Robinson R22 Bear Paws

Greg,

As discussed this morning, we would like to add the Robinson R22 to our R44 Bear Paws Approval (STC SH05-17).

We have fabricated a set of R22 bear paws for E&B Helicopters. A flight test is needed to add this configuration to the STC. Attached is a proposed flight test plan, essentially the same as used for the R44. If the test plan is acceptable, we can proceed with arranging a test flight.

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Please let me know if you have any questions or concerns.

Jeff Clarke
Technologist

Jeff Clarke

From: Oucharek, Gregory [OUCHARG@tc.gc.ca]
Sent: Tuesday, January 17, 2006 8:54 AM
To: jeff@aerodesign.ca
Subject: RE: Robinson R22 Bear Paws

Jeff,

Before I get Flight Test involved, can you confirm who will be conducting the test (Mr. Wilcox was pilot on the original approval) and that Ted is participating as Test Witness. These details can be included on the CP when you submit the application package as I also transmit the CP with the Test Plan.

Thanks,

Greg

> -----Original Message-----
> **From:** Jeff Clarke [mailto:jeff@aerodesign.ca]
> **Sent:** Monday, January 16, 2006 10:46 AM
> **To:** Oucharek, Gregory
> **Subject:** Robinson R22 Bear Paws
>
> Greg,
>
> As discussed this morning, we would like to add the Robinson R22 to our R44 Bear Paws Approval (STC SH05-17).
>
> We have fabricated a set of R22 bear paws for E&B Helicopters. A flight test is needed to add this configuration to the STC. Attached is a proposed flight test plan, essentially the same as used for the R44. If the test plan is acceptable, we can proceed with arranging a test flight.
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> Along with the bear paws, a mirror installed on the forward end of the skid tube is desired for observing cargo on both the R22 and R44. This is an ideal time to get all testing finished for both projects in one trip. Attached is a proposed flight test plan for the mirror installation, as well as some pictures of a similar installation. The mirror is a 5" or 6" diameter convex mirror. This installation will use curved washers to match the curvature of the skid tube for mounting the mirror (not done on other available installations), and the mirror is secured with an AN5 bolt. Per your request, an application for this project is on the fax now.
>
> Please let me know if you have any questions or concerns.
>
> Jeff Clarke
> Technologist

AERO DESIGN LTD.
2013 – 39 Avenue N.E., Calgary, Alberta, T2E 6R7

Tel: 403-250-8027
Fax: 403-250-8333
aerodesign@telusplanet.net

FAXED
16 JAN 2006

16 January, 2006

Transport Canada
Aircraft Certification Division
800-1601 Airport Road
Calgary, Alberta
T2E 6Z8

Attn: Greg Oucharek

Your File : Not Assigned
Our File : 649

Re: Robinson R22/R44 Mirror Installation

Greg,

Please find attached the following documents related to this project:

Modification Approval Request Application Form	MOD649	Revision 0
Compliance Program	CP649	Revision 0
Project Summary	PS649	Revision 0

Regards,

Jeff Clarke, CET

Encl.

Title: **Mirror Installation**

Approval: STC

Customer: AERO Design Ltd.

Type and Model: Robinson R22, R44

Project Summary:

A mirror is required for the pilot to watch loads that are slung from the cargo hook. This installation will install a commercially available 5" to 6" diameter mirror. The mirror is attached to the forward end of the right skid tube.

Note that Changed Product Rule does not apply to the R22 and R44 in accordance with AMA 500/16, section 8.1. Both are non-turbine powered rotorcraft with a maximum weight under 3000 lbs.

APPLICANT: AERO Design Ltd.
2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

CORRESPONDANCE TO: AERO Design Ltd.
(If other than applicant) 2013 - 39th Ave N.E.
Calgary, Alberta, T2E 6R7

DATE: January 16, 2006
REV. No. 0

MAKE: Robinson
MODEL: R22, R44

REGISTRATION: All eligible
SERIAL No.: All eligible

NATURE OF WORK: Mirror Installation

MODEL CERTIFICATION BASIS: FAR 27, February 1, 1965, including amentments 27-1 through 27-24
MODIFICATION CERTIFICATION BASIS: FAR 27, February 1, 1965, including amentments 27-1 through 27-24

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
Subpart B	**Flight**				
27.29	Empty Weight and Corresponding C of G	Weight and Balance data on inst. dwg		X	
27.45	Performance – General	N/A			|
27.51	Takeoff	N/A			|
27.65	Climb: All Engines Operating	N/A			|
27.67	Climb: One Engine Inoperative	N/A			| These sections are not applicable because
27.73	Performance at Minimum Operating Speed	N/A			| the installation is low profile and will have
27.75	Landing	N/A			| negligible effect on the performance and
27.79	Limiting Height-Speed Envelope	N/A			| stability of the helicopter. Flight test is
27.141	Flight Characteristics – General	N/A			| required to determine there is not excessive
27.143	Controllability and Maneuverability	N/A			| vibration and flutter of the landing gear.
27.161	Trim Control	N/A			|
27.171	Stability: General	N/A			|
27.173	Static Longitudinal Stability	N/A			|
27.175	Demonstration of Static Longitudinal Stability	N/A			|
27.251	Vibration	Flight test	X		Flight test to determine that installation does not cause excessive vibration of the landing gear
Subpart C	**Strength Requirements**				
27.301	Loads	Statement in report		X	|
27.303	Factor of Safety	Statement in report		X	| Mirror weighs about 0.5 lb. Loads are not
27.305	Strength and Deformation	Statement in report		X	| significant
27.307	Proof of Structure	Statement in report		X	|

Airworthiness Requirement	Subject for Compliance or Documentary Proof	Form of Substantiation	DOT	DAR	Comments
27.337	Limit Maneuvering Load Factor	Statement in report		X	| Mirror weighs about 0.5 lb. Loads are not
27.561	Emergency Landing Conditions – General	Statement in report		X	| significant
Subpart D	**Design and Construction**				
27.601	General	Use of conventional design		X	
27.603	Materials	Specification on drawings		X	
27.605	Fabrication Methods	Specification on drawings		X	
27.607	Fasteners	Specification on drawings		X	
27.609	Protection of Structure	Specification on drawings		X	
27.611	Inspection Provisions	Design		X	
27.613	Mat'l Strength Properties and Design Values	Use of MIL-HDBK-5		X	
27.629	Flutter	Flight Test	X		Flight test to determine that installation does not cause excessive flutter of the landing gear
Subpart G	**Operating Limitations and Information**				
27.1529	Instructions for Continued Airworthiness	ICA provided	X		

MODIFICATION APPROVAL REQUEST APPLICATION FORM

MOD649, Rev. 0

1. NAME AND ADDRESS OF APPLICANT:

AERO Design Ltd.
2013 39th Ave NE
Calgary, AB, T2E 6R7

2. IDENTIFICATION OF PRODUCT

MAKE:	MODEL:
Robinson	R22, R44

ALL CORRESPONDANCE TO:
AERO Design Ltd.
2013 39th Ave N.E.
Calgary, AB T2E 6R7

SERIAL No.:	REGISTRATION:
All eligible	All eligible

3. REQUEST FOR:

A.	SUPPLEMENTAL TYPE CERTIFICATE (STC)	☒	
B.	STC/STA REVISION	☐	STC/STA No.
C.	LIMITED SUPPLEMENTAL TYPE CERTIFICATE (LSTC)	☐	
D.	LIMITED STC/STA REVISION	☐	LSTC/LSTA No.
E.	F.A.A. SUPPLEMENTAL TYPE CERTIFICATE	☐	
F.	F.A.A. STC REVISION	☐	STC No.
G.	FAMILIARIZATION OF F.A.A. STC	☐	STC No.
H.	REPAIR DESIGN APPROVAL (RDC)	☐	
I.	PARTS DESIGN APPROVAL (PDA)	☐	

4. TITLE OF MODIFICATION OR REPAIR:

Mirror Installation

5. BRIEF DESCRIPTION OF MODIFICATION OR REPAIR:

A mirror is required for the pilot to watch loads that are slung from the cargo hook. This installation will install a commercially available mirror. The mirror is attached to the forward end of the right skid tube.

6. APPLICABLE TYPE APPROVAL (TA) OR TYPE CERTIFICATE (TC) DOCUMENTS:

A. TA NO. H-97 (R44) B. TC No. H10WE (R22) C. OTHER _____

7. PROPOSED BASIS OF APPROVAL:

A. SAME AS TA ☒ B. SAME AS TC ☐ C. OTHER ☐ (Please specify) _____

8.

DOCUMENTATION CHECKLIST	REQUIRED		FOR DOT USE ONLY		
			RECEIVED		
	YES	NO	YES	NO	DATE
COMPLIANCE PROGRAM	X				
MASTER DRAWING LIST	X				
FLIGHT MANUAL SUPPLEMENT		X			
MAINTENANCE MANUAL SUPPLEMENT		X			
INSTRUCTIONS FOR CONTINUING AIRWORTHINESS	X				
ENGINEERING REPORTS	X				
DESIGN DRAWINGS		X			
MANUFACTURE DRAWINGS & INSTALLATION INSTRUCTIONS	X				
ELECTRICAL LOAD ANALYSIS		X			
DRAFT STC, LSTC OR RDA		X			
WEIGHT AND MOMENT CHANGE	X				
FLIGHT TEST DATA		X			
OTHER (Specify)					

9. APPLICANT'S REMARKS:

10. In addition to the payment of Aircraft Certification approval fees as prescribed in Canadian Aviation Regulations (CAR) Section 104, I agree to reimburse Transport Canada incremental expenses as in Aviation Regulation Directive No. 3, or equivalent, as applicable. For further details governing cost recovery, refer to AMA 513/4.

PER: _____ Consultant 16 January, 2006
SIGNATURE OF APPLICANTS TITLE DATE

11.

_____ _____
SIGNATURE OF REGIONAL ENGINEER DATE